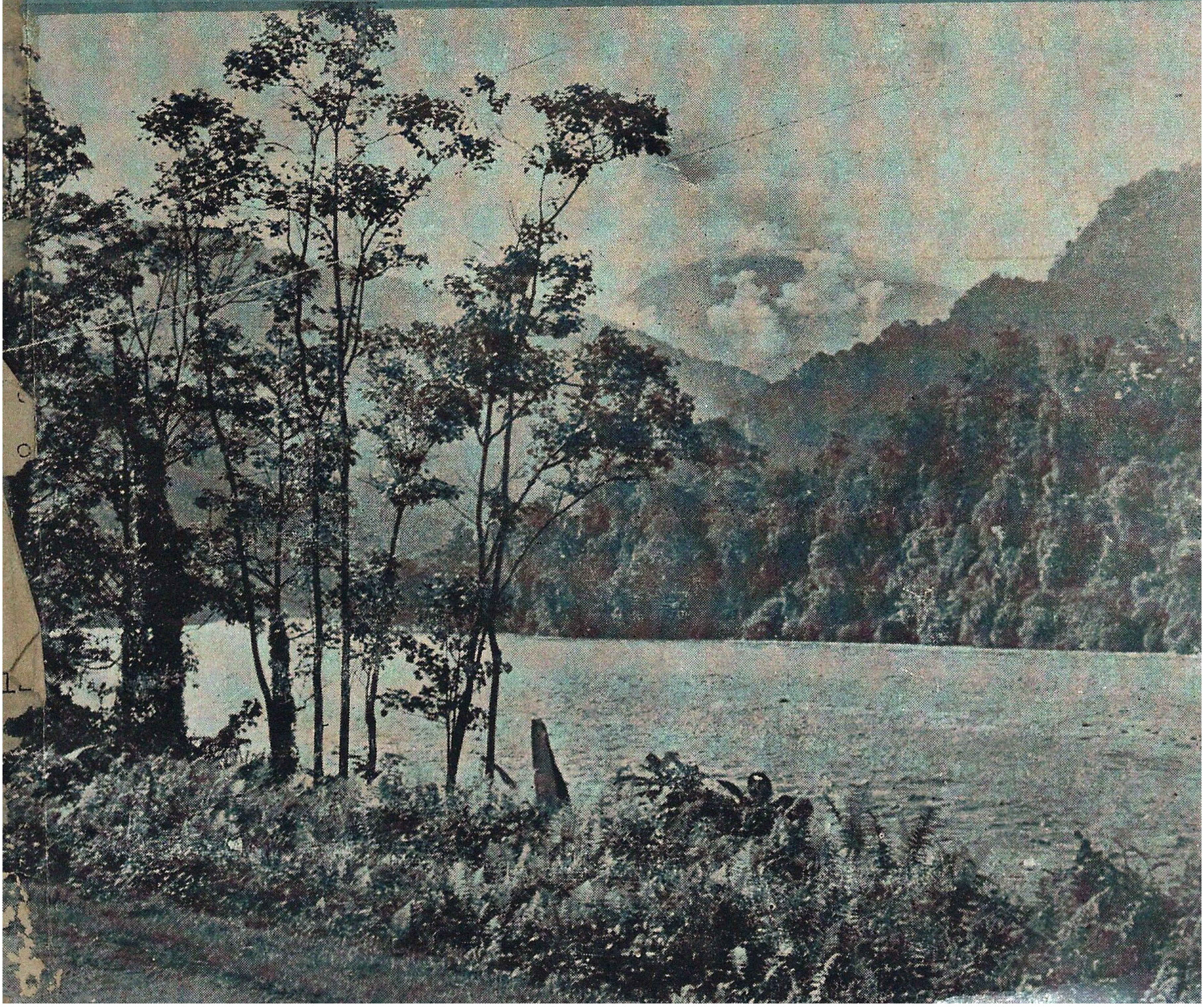
JULY, 1982

THE INDIAN FORESTER

FOUNDED IN 1875

OFFICE OF THE CHIEF CONSERVATOR ... 26 NOV 1982



Telegram : Indian Forester Telephone: 27021/264

INDIAN FORESTER

(A Monthly Journal of Forestry and Forestry Research)

BOARD OF MANAGEMENT

Chairman—N.D. Bachkheti, I.F.S., Inspector General of Forests, New Delhi.
Vice Chairman—K.M. Tiwari, I.F.S., President, Forest Research Institute & Colleges, Dehra Dun.

MEMBERS

Andamans : W.B. BATHEW, I.F.S.; Andhra Pradesh : A.K. MATHUR, I.F.S.; Arunachal Pradesh : R.N. KAUL, I.F.S.; Assam: S. RAJKHOWA, I.F.S.; Bihar : J.N. PANDEY, I.F.S.; Dadar & Nagarhaveli : K.D. SINGH, I.F.S.; Goa : P.P MALHOTRA, I.F.S.; Gujarat : M.S KHANCHANDANI, I.F.S.; Haryana : GURNAM SINGH, I.F.S.; Himachal Pradesh: V.K. SHARMA, I.F.S.; Jammu & Kashmir: SOHAN SINGH, I.F.S; Karnataka : SHYAM SUNDER, I.F.S.; Kerala : A. HASSANKUTTY, I.F.S.; Maharashtra : I.M. QURESHI, I.F.S.; Madhya Pradesh : V.K. SETH, I.F.S.: Manipur : B.S.K. SARMA, I F.S.; Meghalaya : P.S. INGTY, I.F.S.; Mizoram : R.N. LOGANEY, I.F.S.; Nagaland : D.K. ZELIANG, I.F.S.; Orissa : S.N. DAS, I.F.S.; Punjab (I) : A.S. SIDHU, I.F.S.; Rajasthan : K.K. GUPTA, I.F.S.; Sikkim : P.O. PAZO, I.F.S.; Tamil Nadu : T. ACHAYA, I.F.S.; Tripura : A K. GHOSH, I.F.S.; Uttar Pradesh : C.L. BHATIA, I.F.S. West Bengal : P.K. RAY, I.F.S.

RULES OF MANAGEMENT

1. *Pre-payable Annual Subscription* :—

INDIA FOREIGN (Inclusive of Postage)	SINGLE COPY (Current and Back issue) (Exclusive of Postage)
Rs. 80.00, $ 18.00 or £ 9.00	India Rs. 8.00, Foreign $ 2.00 or £ 1.00

Note :—Subscriptions are generally booked for a Calendar Year (JANUARY-DECEMBER), and/or from JULY-JUNE. Copies for intermediate months (of current issue) can, however, be supplied on payment, if available.

2. *Concessional Rates of Annual Subscription* (Applicable to Serving Forest Officers & Forest Scientists in Government Institutes and Government Departments in India only) :—

(a) Those drawing a Salary of less than Rs. 500 p.m. ... ...Rs. 50.00 per Annum
(b) „ „ „ „ Rs. 700 „ ... ...Rs. 60.00 „ „

3. *Life Subscription* :—Forest Officers, on retirement from service in India, can obtain copies of the *Indian Forester* for life by one Single Payment of Rs. 300.00 or its equivalent. A life Subscriber will be enrolled as such hand entitled to receive copies of the Journal from the date of receipt of the full amount of his Life Subscription Request for back numbers of the Journal will not be entertained. These can, however, be supplied, if available, on payment fixed for back numbers.

4. *Advertisement Tariff* :—(The rates are exclusive of blocks, etc. and are liable to change WITHOUT NOTICE). All Advertisement Matter is strictly subject to the approval of the Management.

N.B.—The Table below shows Contract Rates for and over SIX and TWELVE Insertions respectively to be consumed in one YEAR or THREE Insertions booked at a time and printed in three successive Issue of the Journal. The figures in the right-hand column denote Charges for Casual and Single Insertions.

space	12 Insertions	6 Insertions	3 Insertions	Casual (Per Insertion)
Full Page	Rs. 1500.00	Rs. 800.00	Rs. 450.00	Rs. 150.00
Half Page	Rs. 900.00	Rs. 500.00	Rs. 300.00	Rs. 100.00
Quarter Page	Rs. 600.00	Rs. 350.00	Rs. 225.00	Rs. 80.00
2.5 cm Across Page	Rs. 500.00	Rs. 300.00	Rs. 200.00	Rs. 70.00

Note :—(1) Extra charges over the above Rates for (*a*) Multi-Colour Insertions (up to four colour only) 75%
(*b*) Double-colour (Red only or Red and Black)—25%; (*c*) Advertisement on Art Paper—25%
(*d*) Special position, e.g. (*i*) First page facing inner fly-page of front Title-cover, and (*ii*) facing Editorial page—25%; (allowed only in case if a full-page space in taken).

(2) Half-tone and Line Blocks, Stereos, and Matrices accepted. Blocks of all description and/or other Advertisements material are to be supplied by the Advertising parties themselves.

(3) screen used for Advertisements : 80—100.

(4) Only one *Voucher Copy* will be applied Overall Size : 24 cm × 18.5 cm; Printing Size (Full-page) 20 cm × 15 cm.

Important—(*a*) Advertisement charges are strictly Payable in advance preferably by a bank Draft on State Bank of India, Dehra Dun, U.P. (India); and drawn in favour of the Business Manager *Indian Forester* (*b*), The Advertisement matter, which should be TYPEWRITTEN in BLOCK LETTERS or ITALICS, must reach us EIGHT WEEKS (10 WEEKS in case of multi-colour insertions) before the appearance of an issue for which an advertisement is intended, and should always be sent in DUPLICATE. For further particulars and of terms business please apply to the Business Manager, *Indian Forester*

(5) Correspondence concerning subscriptions, etc., should be addressed to the Business Manager, *Indian Forester*, P.O New Forest, Dehra Dun (India). All payments on account of subscriptions and Advertisement, etc., must, however, be made in the name of the Business Manager, *Indian Forester*, and Cheques, etc., drawn in his favour.

(6) All complaints regarding delay in receipt or non-delivery of a copy or copies of the *Indian Forester* should be made WITHIN 30 DAYS from the due date of publication of an issue which is 1st of each month to the Business Manager, *Indian Forester*, P.O. New Forest, Dehra Dun. Efforts will be made to supply duplicate copy or copies of the missing number. *free of cost*, provided a complaint is received in time, and on payment if a complaint as received after 30 days subject to the availability of a copy or copies in stock in their case.

(7) In case of dispute, Dehra Dun U.P. (India), shall be the place of jurisdiction.

376/82

VOLUME 108 NUMBER 7

THE
INDIAN FORESTER
JULY, 1982

INTERRELATIONSHIP OF WOOD YIELD COMPONENTS IN *EUCALYPTUS TERETICORNIS*

M. RATHINAM,* C. SURENDRAN† AND S. KONDAS‡
Department of Forestry,
Tamil Nadu Agricultural University, Coimbatore

Introduction

The development, growth and wood yield of a tree is a composite biological function, the expression of which is related to a number of component traits such as height of the tree, branching habit, thickness of tree, rate of growth etc. A preliminary survey of natural variability of the yield components observed in plantations of *Eucalyptus tereticornis* under different agroclimatic regions in Tamil Nadu indicated a large variation in each of the component traits Genetic improvement of this species with respect to biomass production was taken up in the Department of Forestry, Tamil Nadu Agricultural University, Coimbatore-3 in June 1976. To initiate a scheme of research projects and to conceive the biological relationship of the tree components to the biomass production of the tree, a beginning was made in a biometrical study of the tree component traits in *Eucalyptus tereticornis* plantations and the results obtained are discussed in this paper.

Materials and methods

Plantations of *Eucalyptus tereticornis* are distributed all over Tamil Nadu under different agroclimatic and of different duration of growth. The plantation in Sengeerai (Pudukkottai) was subjected to biometrical assessment of the wood yield components The plantation was raised in the year1968 and it represents a region receiving an annual precipitation of 800-900 mm mostly in the North-east monsoon season The traits that were considered are :

(1) Total height
(2) Merchantable height
(3) Girth at breast height
(4) Girth at breast level
(5) Bark thickness at stump level
(6) Weight of green bark
(7) Weight of green billets under bark

---

*Associate Professor (Breeding). †Asstt. Professor (Breeding).
‡Professor & Head of the Department.

The stratified sampling technique was adopted in the selection of 75 trees and the same were felled on the spot and the biometrical data were recorded. In the plantation three representative areas of a hectare at random distributed over an area of ten hectares were chosen for the study and the recordings were done in October 1976.

1. Total height : The total height of the tree from the base of the tree to the tip of the main stem was measured as the total height
2. Merchantable height : The length of the tree from the base to the top upto 5 cm in diameter was taken as merchantable height.
3. Girth at breast height : The girth of the tree at breast height in cm was recorded.
4. Girth at stump level : The girth of the tree at the base 5 cm above the ground level was measured in cm.
5. Bark thickness at stump level : After the tree was felled, the thickness of the bark was measured in cm at the cut surface of the stump.
6. Weight of green bark : Immediately after debarking, the green bark of the entire tree was weighed.
7. Weight of green billets under bark : The fresh billets after debarking were weighed.

Statistical analysis. The data collected were statistically analysed to estimete the coefficient of variation and correlation coefficients. The correlation coefficient was partitioned into direct and indirect affects by raising the path coefficient analysis. A path diagram was constructed to depict the direct and indirect effect of the various components. For the association of yield components to the wood-yield, the latter was taken as the independent trait and the extent of association of the other six traits was studied.

The mean, range and coefficient of variation in respect of each of the tree characters are presented in Table 1.

Table 1

Details of expression of biometrical traits in 1968 C Sengeerai Eucalyptus tereticornis plantation

Sl. No.	Character	Mean (75 trees)	Range	Coefficient of variation
1.	Total height	14.47 ± 0.2931 ms	8.63 to 19.30 ms	17.54%
2.	Merchantable height	11.00 ± 0.2933 ms	3.93 to 15.80 ms	23.09%
3.	Girth at breast height	36.92 ± 1.0564 cm	18 to 62 cm	24.78%
4.	Girth at stump level	51.49 ± 1.3345 cm	29 to 74 cm	22.44%
5.	Bark thickness at stump level	0.91 ± 0.04 cm	0.5 to 2.0 cm.	35.64%
6.	Weight of bark	12.53 ± 0.9414 kg	1 to 31 kg	65.06%
7.	Weight of green billets after debarking	66.13 ± 4.5557 kg	11 to 181 kg	59.66%

The associations of the six tree traits individually with the biomass production (as seen in the weight of green billets under bark) and among the traits are presented in Table 2.

Table 2

Correlation Coefficients between seven characters—Sengeerai plantation

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
Total height X_1	—	0.7228**	0.8378*	0.7878**	0.3005**	0.8378**	0.8781**
Merchantable height X_2	—	--	0.8098**	0.7519**	0 3144**	0 6408**	0.8234**
Girth at breast height X_3	—	—	—	0.9602**	0.5317**	0.8280**	0.9488**
Girth at breast height X_4	—	—	—	—	0.5158**	0.8185**	0.9072**
Bark thickness at stump level X_5	—	—	—	—	—	0.5218**	0.3584**
Weight of green bark X_6	—	—	—	—	—	—	0.8060**
Weight of green billets after debarking X_7	—	—	—	—	—	—	—

**Significant at 1% level (P=0.01)

The direct and indirect effects of the individual tree traits as obtained from the path coefficient analysis are given in Table 3.

Table 3

Sengeerai plantation—Path Coefficients (Direct and indirect effects)

Sl No.	1	2	3	4	5	6	'r'
1.	0.1748*	0.0637	0.6408	0.0186	−0.0474	0.0270	0 8775
2.	0.1263	0.8820*	0.6194	0.0178	−0.0496	0.0206	0.8227
3.	0.1464	0.0714	0.7649*	0.0227	−0.0839	0.0261	0.9476
4.	0 1377	0.0663	0.7344	0.0237*	−0.0818	0.0264	0.9067
5.	0.0505	0.0277	0.4066	0.0122	−0.1578	0 0168	0.3560
6.	0.1464	0.0565	0.6333	0 0193	−0.0823*	0.0323*	0 8055

Residues = 0.0289

Figures marked * indicate the path coefficients (direct effects) and rest being indirect effects.

1. Total height,
2. Merchantable height,
3. Girth at breast height,
4. Girth at stump level,
5. Bark thickness at stump level,
6. Weight of bark.

Results and discussion

The biomass production of the tree is the main target of tree breeding and it is a complex trait related to other component traits. In any tree breeding programme, selection of superior tree forms the basis and the crucial aspect of the scheme. In a natural population, the expression of the component traits vary to a great extent and it varies very widely in a naturally cross-fertilized species such as *Eucalyptus* than in a naturally self-fertilized species. As the range in variation of the individual traits increases, the problem of the tree breeder in the choice of the desirable trees become more complicated. However, the statistical analysis of the biometrical data of the component traits has come to the aid of the tree breeder not only in the proper understanding of the relationship of the individual tree traits with the biomass production as well as the inter-relationship within themselves and also in determining the extent of influence of the individual traits on the biomass production besides the direct and indirect effects of the individual tree traits on the biomass production.

The data presented in Table 1 and the mean, range of expression of individual traits and the coefficient of variation presented in Table 2 have brought out the nature of distribution of the variation in each of the traits in a natural population.

The coefficient of variation is maximum (65 06%) for the trait weight of green bark followed by weight of green billets after debarking. It is minimum for the trait total height in the plantation. The height of trees exhibits less variation than the other traits indicating that the environment plays a dominant role in the determination of the height of the plant. In the case of the traits, weight of green billets after debarking and weight of green bark, more variation is noticed in the plantation. It would indicate that the genotype has influenced the expression of these traits to a large extent.

Association of traits with wood yield. The correlation coefficients of the first six traits individually with the weight of the green billets under bark were found to be significant at 1% level (Table 2). The correlation coefficient between the girth at breast height and wood-yield is found to be the highest followed by that between girth at stump level and wood-yield. Between bark thickness at stump level and wood-yield the correlation coefficient is the least although statistically significant.

Among the associations of merchantable height with the next four traits namely girth at breast height, girth at stump level, bark thickness at stump level and weight of green bark, that with the girth at breast height is the highest and that with the bark thickness at stump level is the lowest.

Among the associations of the girth at breast height with the next three traits, namely girth at stump level, bark thickness and weight of green bark, that with the girth at stump level is the highest and that with the bark thickness at stump level is the lowest.

Among the associations of the girth at stump level with the next two traits, namely bark thickness at stump level and weight of green bark that with the weight of the bark is higher than that with the bark thickness at stump level.

In the biometrical assessment of the correlation coefficient, the calculation of the association between the basal area at breast height and the weight of green billets appear to be more relevant and indicative than that between girth at breast height and weight of the green billets. The data worked out are given in the table below.

Correlation coefficient between basal area at breast height and weight of green billets under bark

	Correlation coefficient value Sengeerai
Between basal area at breast height and weight of green billets	0.9912**
Between girth at breast height and weight of green billets	0.9488**

Path coefficient analysis. Path coefficient analysis is a standardised partial regression coefficient and as such measures the direct influence of one variable upon another and permits separation of correlation coefficient into components of direct and indirect effects (Dewey and Lu, 1959). The contribution of wood-yield component traits to the weight of the green billets under bark has been partitioned into direct and indirect effects by path analysis and it also aids to rank the order of importance given to the different traits on a sound basis. The results of the path analysis of Sengeerai plantation (Table 3) indicate that girth at breast height contributes the maximum direct effect on yield (0.7649) followed by the total height of the tree (0.1748). Even though the merchantable height the girth at stump level and the weight of green bark shows positive direct effect on wood-yield, their influence is the least Of the traits studied, the thickness of bark shows only negative direct effect on wood-yield,

The total height of the tree has maximum indirect effect through the girth at breast height and negligible indirect effect through other traits.

Merchantable height shows similar trend. The girth at breast height shows the maximum indirect effect only through the total height.

Even though the bark thickness shows negative direct effect on wood-yield, it influences, the yield through the maximum indirect effect of the girth at breast height.

The weight of green bark influences the wood-yield through the maximum indirect effect of the girth at breast height.

The path coefficient analysis of the data from the plantation confirms the indications of correlation coefficients, that the girth at breast height bears a close relationship to the biomass production. But in respect of other traits, although the correlation coefficients bring out stronger associations with the weight of green billets except that of bark thickness at stump

level, it is the path coefficient analysis that bring out the real association of the traits to the biomass production. From the studies made it is confirmed that the girth at breast height can be taken as a selection index in the breeding programmes.

Acknowledgement

The cooperation and encouragement extended in this study by the Tamil Nadu Forest Plantation Corporation and State Department of Forestry are acknowledged. The financial support of the scheme by M/s. Seshasayee Paper and Board Limited, Erode and M/s. South India Viscose Limited, Mettupalayam is also acknowledged. The assistance by the staff in this study is acknowledged.

SUMMARY

Biometrical studies were made in a plantation of *Eucalyptus tereticornis* in 1976 on seven tree traits namely, total height, merchantable height, girth at breast height, girth at stump level, bark thickness at stump level, weight of green billets after debarking and weight of green bark. Statistical evaluation involving correlation coefficients and path coefficient analysis has brought out the individual influence of the tree traits on the biomass production. The girth at breast height can be taken as a selection index in *Eucalyptus* tree breeding.

युकेलिप्टस टेरेटिकार्निस में काष्ट प्राप्ति के अवयवों का पारस्परिक सबन्ध

लेखक एम० रतिनम्, सी० सुरेन्द्रन् व एस० कोण्डास

सारांश

युकेलिप्टस टेरेटिकार्निस के रोपवन में 1976 में सात वर्षीय वृक्ष के लक्षणों नामत: कुल ऊंचाई, विक्रेय ऊंचाई, वक्षोच्चता परिधि, स्थूण स्तर परिधि, स्थूण स्तर वल्क मोटाई, छाल उतारने पर हरे कुन्दों का भार और हरी छाल का भार पर जैवमापिकीय अध्ययन किए गए। सांख्यिकीय मूल्यांकन ने, जिसमें सह संबन्ध गुणांक और पथ गुणांक विश्लेषण किए गए, जैवपुंज उत्पादन पर वृक्ष लक्षणों के व्यष्टि प्रभावों को प्रदर्शित किया है। युकेलिप्टस वृक्ष प्रजनन कार्य में वक्षोच्चता पर वृक्ष परिधि को चुने हुए निर्देशांक के रूप में ग्रहण किया जा सकता है।

Reference

Dewey, D.R. and K.H. Lu (1959). A correlation and path coefficient analysis of Components of crested wheat grass seed production *Agron, J.* 51: 515–8.

———

A COMPARATIVE STUDY OF SALINE-SODIC, SODIC AND NORMAL SOILS IN RELATION TO FOREST GROWTH OF SOUTH KHERI FOREST DIVISION, (U.P.)

K. SINGH, S.K. SHARMA, R.M. SINGHAL, J.S. SAMRA AND S.D. SHARMA

Forest Soil-cum-Vegetation Survey,
Forest Research Institute & Colleges, Dehra Dun, India

Introduction

In India, about 7 million hectares of land is estimated to be affected by soil salinity/sodicity in various states of the country. South Kheri Forest Division of the Central Circle of Uttar Pradesh is one of the Divisions of which southern vested forests and waste lands are affected by soil salinity and/or sodicity although, salinity is also developing in a part of old reserve forest due to seepage from canals and poor drainage conditions. Since salt-affected soils vary greatly in their characteristics and also the forest species differ in their tolerance for salinity/alkali levels, it is important before any large scale afforestation programme is taken up, to determine the range of salinity and sodicity level within which a given species can grow and also those within which it fails to survive Yadav and Singh (1970) determined the tolerance limit of a few important forest species to the varying degrees of salinity and alkali levels for the soils of Vrijbhumi Forest Division, Agra. Their recommondations can not be generalised for a large area of saline and alkali soils because of varying site characteristics and soil conditions.

The present study was therefore undertaken to study (i) saline-sodic soils. (ii) sodic soils and (iii) normal soils in South Kheri Forest Division (U P.) in order to ascertain tolerance limits of a few local forest species to varying site conditions of the Division.

Materials and methods

South Kheri Forest Division lies well outside the hills in the northern part of Gangetic alluvial plain at an altitude of about 120–175 m in the Central Circle of Uttar Pradesh The main mass of old reserve forests and the adjoining vested forests lie beetween 28° and 28°30′ north latitude and 80°16′ and 80°35′ east longitude. A large number of vested forests and waste lands extend upto 27°47′ north latitude in the south, upto 81°1′ east longitude in the east and 79°59′ east longitude on the west. Average annual rainfall of the tract at Mailani is 1131 mm whereas it is 861 mm in Mohamadi. Most of the precipitation is received during the months of July-September. Bishokar block of Mohamadi Range in south is one of the detached forest blocks of the vested forests lying at lower altitude, having lower precipitation and hot and dry climate than the old reserved forest of Mailani (Chandra, 1972).

Three soil profiles representing the site conditions of (i) saline-sodic soils, where all forest species have failed to grow completely, (ii) sodic soils, where there is a fair growth of

natural tolerant forest species, and (iii) Normal soils where there is a good stand of natural sal forest; were studied. Soil samples were analysed for particle size analysis, organic matter, and nitrogen (Black, 1965), $CaCO_3$ (Piper, 1944), Gypsum requirement, cation exchange capacity, exchangeable cations and studies in saturation extract (Richard, 1954).

Results and discussion

The site characteristics of the soil profiles and growth status of natural forest vegetation are given in Table 1. The brief morphological description of soil profiles highlighting the differentiating characteristics are furnished below. The relevent analytical data are reported in Table 2 and 3.

Differentiating morphological characteristics of soil profiles are : (i) surface salt incrustation-present only in profile 1. It is white and about 5 cm thick, (ii) Soil colour-lighter in profile 1 (yellowish brown) but darkness increases in profile 2 and still more in profile 3, (iii) texture-silty loam in profile 1, silty clay loam to silty loam in profile 2 and, loamy sand in profile 3, (iv) structure of subsoils columnar in profile 1 and 2 but subangular blocky in profile 3, (v) Presence of $CaCO_3$ *(Kankar)* nodules mixed in clay pan only in profile 1, (vi) Presence of roots and krotovinas-abundent in profile 3, many in profile 2 but absent in profile 1, and (vii) soil mottlings-present in profile 1 and 2 at variable depths.

Profile 1: Saline-sodic soils where all forest species failed to grow completely. Occurrence of soil mottlings at a very shallow depth (48-128 cm) indicates high water table and poor drainage, both surface and internal. This may be due to undulated topography and root growth limiting impervious pan of clay mixed with $CaCO_3$ nodules.

Soils are poor in organic matter and nitrogen (Table 2). They have low values of cation exchange capacity and high exch Na. The values of gypsum requirement (65 to 12.4 me%) suggests addition of gypsum to the soil before starting some large scale afforestation in the area.

On the basis of data presented in Table 3 regarding pH (10.3 to 9.7), Electrical conductivity (< 320 m mhos/cm) and ESP (91 to 24); these soils have been classified as saline-sodic soils as per the limits suggested by Richard (1954). Among anions carbonate + bicarbonates predominate followed by chloride so the soils have been classified as 'CO_3-Cl type saline sodic soils'. Presence of high amount of soluble salts predominated by carbonates of sodium, and /or exch Na are the causes of high alkalinity.

As brought out in morphological and physico-chemical descriptions, presence of surface salt incrustation due to capillary rise of soluble salts with ground water, high water table, poor drainage, columnar structure of natric horizon, compact and indurated calcic horizon and high values of pH, EC and ESP are the main impediments for the germination of seeds and growth of plants. To overcome these problems improvement of drainage conditions, incorporation of gypsum+organic manures and to adopt suitable soil working and planting techniques are being suggested. Application of gypsum at the rate equivalent to 1/4th of

Table 1

Site characteristics and vegetation of South Kheri Forest Division (U.P.)

Profile No.	Location	Physiography & Slope	Broad Soil Class	Drainage		Vegetation
				Surface	Internal	
1	2	3	4	5	6	7
1.	Bishokar-3 (Mohamadi Range)	Moderately undulated with gentle slope.	Saline-sodic	Slow	Very slow	Completely barren lands
2.	Bishokar-2A (Mohamadi Range)	Slightly undulated with very gentle slope	Sodic	Medium	Slow	Trees-*Diospyros tomentosa* (H4, G. 0.29), *Butea monosperma* (H6, G 0.51), *Madhuca indica* (H 21, G 0.15), *Wrightia tomentosa* (H4, G 0.31), *Syzygium cumini* (H8,G 0.20) & *Mallotus pnilippinensis* (H 7, G 0.09) Bushes-*Diospyros tomentosa, Mallotus philippinensis, Cassia fistula.* Grass-*Desmostachya bipinnata.*
3.	South Mailani-8 (Mailani Range)	Nearly flat lands with very gentle slope	Non-saline non-sodic	Medium	Medium	Trees-*Shorea robusta* (H 24, G 0.89) Others in middle storey :- *Mallotus philippinensis* (H 6, G 0.31), *Wrightia tomentosa* (H 9, G 0.37), *Syzygium cumini* (H 15, G 0.74) & *Millusa valutina* (H 3, G 0.16). Bushes-*Clerodendrum viscosum, Murraya koenigii, Mallotus philippinensis* and *Lantana* sp.

H = Average height (m) and G = Average GBH (m)

Table

Important physical and chemical properties of

Profile No.	Depth (cm)	Horizon	> 2mm Soil mass (%)	Particle size analysis Sand (%)	Silt (%)	Clay (%)	Textural class (%)	Organic matter (%)
1	2	3	4	5	6	7	8	9
1	Salt incrust	—	4.38	77.4	21.4	1.2	LS	0.21
	0-18	A1	14.88	60.3	33.9	5.8	SiL	0.28
	18-48	B22t	22.48	58.6	31.7	9.7	SiL	0.17
	48-78	B23t	16.10	57.7	32.1	10.2	SiL	0.17
	78-128	IIA1Ca	11.86	63.0	29.3	7.7	SiL	0.14
	728-190	IIB21t	20.09	32.4	50.9	16.7	Si	0.10
2.	0-42	A1	8.97	37.1	34.6	28.3	SiCL	1.52
	42-65	A21	12.70	39.3	42.4	18.3	SiL	0.69
	65-106	B22t	14.02	31.3	38.5	30.2	SiCL	0.52
	106-154	B31	9.96	42.8	42.0	15.2	SiL	0.17
	154-180	B32	15.96	48.4	35.4	16.2	SiL	0.17
3.	0-13	A1	8.37	80.0	12.5	7.5	LS	1.74
	13-72	B21	6.23	83.5	10.4	6.1	LS	0.35
	72-185	B22	10.64	82.8	10.8	6.4	LS	0.10

2

Soils in South Kheri Forest Division (U.P.)

Nitrogen (%)	$CaCO_3$ (%)	GR me/100gm	GEC me/100gm	Exchangeable cations me/100 gm			
				Ca %	Mg (%)	Na (%)	K (%)
10	11	12	13	14	15	16	17
0.031	—	65.0	4.78	0.37	0.16	4.33	0.21
0 025	2.35	20.6	10.43	0.75	0.20	7.94	0.53
0.024	1.55	13.0	13.04	0.78	0.01	7.11	0.32
0.023	1.68	13.0	13.04	0.78	0.26	7.34	0.30
0.021	1.78	12.4	13.04	0.78	0.54	5.09	0.24
0.020	1.70	-2.2	12.17	0.79	1.88	2.91	0.12
0 055	0.85	0.6	17.82	1.39	2.27	1.04	0.37
0.050	0.80	-1.2	14.78	1.24	1.70	0.66	0.28
0.046	0.93	-0.4	20.86	0.87	1.48	1.58	0.21
0.024	1.43	10.0	19.13	0.79	1.05	7.37	0.18
0.022	1.10	9.2	15.65	0.39	0.31	6.44	0.11
0.069	0.45	3.6	9.5	1.00	3.08	1.09	0.27
0.024	0.25	1.0	7.8	0.60	1.55	0.05	0.19
0.015	0.23	1.0	7.3	0.50	2.08	0.07	0.18

Table 3

Determinations in saturation extract of soils in South Kheri Forest Division (U.P.)

Profile No.	Depth (cm)	pH (1 : 2.5)	Determinations in saturation extract: EC m. mhos/cm at 25° C	Cations me/l: Ca	Cations me/l: Mg	Cations me/l: Na	Cations me/l: K	Anions me/l: CO_3	Anions me/l: HCO_3	Anions me/l: Cl	Anions me/l: SO_4	SAR	ESP
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Salt incrust.	9.7	320 0	35.50	12.40	3326.09	1.53	2765	267.5	498.0	1.7	665.2	90.7
	0-18	10.2	28.0	1.50	1.72	273.90	0.32	230	72.5	25.0	2.0	217.4	76.2
	18-48	10.3	11.5	0.50	1.65	84.79	0.17	35	85.0	27.5	0.7	82.3	54.6
	48-78	10.3	10.0	0.50	0.98	76.26	0.05	25	80.0	19.5	0.8	88.7	56.3
	78-128	10.2	5·5	0.45	1.70	41.30	0.07	5	57.5	15.5	1.6	40.1	36.6
	128-190	10.0	1.0	0.10	0.44	11.30	0.01	Nil	22.5	16.5	1.4	22.1	24.0
2.	0-42	7.7	0.3	0.05	1.02	4.35	0.10	Nil	17.5	18.5	3.6	6.0	5 8
	42-65	7.3	1.2	3.55	5.05	2.83	0.06	Nil	2.0	2.6	8.0	1.4	4.5
	65-106	7.8	2.3	2.35	4.52	13.04	0.04	Nil	1.5	11.3	15.3	7.5	7.6
	106-154	9.0	1.6	0.15	1.73	13.04	0.07	Nil	17.5	22.1	0.4	13.6	38.5
	154-180	9.3	1.6	0.10	0.22	11.95	0.02	Nil	12.5	27.5	0.3	29.9	41.1
3.	0-13	6.8	0.2	0.05	0.92	0.63	0.16	Nil	8.0	2.5	0.8	0.9	2.8
	13-72	6.8	0.1	0.03	0.72	0.80	0.07	Nil	4.5	5.1	0.5	1.3	0.7
	72-185	6.7	0.1	0.03	0.61	0.05	0.04	Nil	2.3	3.0	0.6	0.1	0.0

gypsum requirement (GR) is adequate to improve the soil conditions for obtaining good yields (Yadav, 1979). Incorporation of gypsum + F.Y.M. in the soil of the planting pit is helpful in improving the conditions of alkali soil (Yadav & Sharma, 1976 and Dalal, 1980). Pyrite, and acid forming amendment can also be used beneficially as reported by Luthra (1980). Several methods of soil working and planting techniques may also be used to obtain good results (Yadav, 1980; Ghosh, 1977; Yadav & Singh, 1970 and Pande, 1967). A technique of growing plants in auger holes to bypass the roots through barriers of these soils, may be used suitably in this area. Forest species like *Prosopis juliflora, Acacia nilotica, Tamarix articulata, Eucalyptus hybrid, E. gomocephala, Casuarina equisetifolia,* etc. can be planted (Yadav, 1980; Lohani, 1978; Yadav & Singh, 1970; Pande, 1967 and Malcolm, 1980) first time after adding suitable amendments and then in second rotation may be switched to other local but tolerant species such as *Madhuca longifolia, Diospyros melanoxylon, Terminalia arjuna, Albizzia procera* etc. (Samra *et al.*, 1980).

Profile 2: Sodic soil where some natural forest species have grown. As shown in Table 1, the important forest species covered in the surrounding area of this profile were *Diospyros tomentosa* (Tendu), *Butea monosperma* (Dhak), *Madhuca indica* (Mahua), *Wrightia tomentosa* (Dudhi), *Syzygium cumini* (Jamun) and *Mallotus philippinensis* (Rohini). The presence of soil mottlings below 106 cm depth indicates comparatively more deep water table as compared to profile 1.

The higher contents of organic matter and nitrogen were found at surface (Table 2). Higher cation exchange capacity of soil is associated with high contents of organic matter and clay. Ca, Mg, and K predominate among the exchangeable cations in top soils whereas Na in the subsoils below 106 cm depth. The $CaCO_3$ contents do not form nodules.

The soil is nonsaline-nonsodic at surface but pH, ESP and SAR values are remarkably higher below 106 cm implying potential alkalinity (Table 3). It may be due to the effect of fluctuation in water table (Richard, 1954 and Agarwal & Yadav, 1956) or due to ameliorative effect of tree growth (Yadav & Singh, 1970). Based on data regarding pH, EC, ESP and soluble anions, these soils can be classified as 'Cl-HCO_3 type sodic subsoils'.

Development of sodicity in subsoil (natric horizon) and deep penetration of organic matter in the profile indicate the presence of good forest in the past. Sodicity might have developed in later stages and only tolerant forest species might have survived. Present forest species in degraded forest are helping us to cheque the further developments of soil sodicity by improving the soil conditions. Therefore, clearfelling of the area should be completely prohibited.

Profile 3: Nonsaline–nonsodic (normal) soils where sal is grown very well. The forest species covered at this site was mainly the natural sal (*Shorea robusta*). Other species present in the middle storey of the forest are given in Table 1. Better drainage conditions both surface and internal, show deep ground water table (about 5 m from surface). Morphological descriptions of this profile reveal that these soils are coarse textured and free from the root growth limiting horizons like calcic, natric, clay pan etc.

The maximum values of organic matter (1.74%) and nitrogen (0.069%) were found at surface (Table 2). The cation exchange capacity of soils is fairly high. Divalent cations dominate the exchange complex of soil due to phytocycling of nutrients Ranking of exch cations on the basis of their dominance, composition of soluble salts, $CaCO_3$ contents and gypsum requirement of soils at surface indicate that clearfelling of such large area may be detrimental to the existing satisfactory soil conditions. On consideration of analytical data (Table 2 and 3), these soils have been categorised as nonsaline-nonsodic.

Comparison of above mentioned three profiles show that good forest growth is associated with soils having better drainage conditions, deep ground water table, favourable soil structure and other morphological features, absence of root growth limiting horizons, fair amount of organic matter and nitrogen, and moderately high cation exchange capacity with base saturation by exch Ca and Mg. Sal *(Shorea robusta)* was found to grow well in nonsaline-nonsodic soils whereas some forest species such as Tendu, Dhak, Mahua, Dudhi, Jamun and Rohini can be grown very well in $Cl\text{-}HCO_3$ type sodic subsoils having pH, EC and ESP below 8.4 m mhos/cm and 10 respectively in surface one metre depth. All forest species failed to grow in $CO_3\text{-}Cl$ type saline-sodic soils which are compact and indurated with cemented bed of *kankar* nodules and that are highly calcareous with pH $>$ 9.7, EC of saturations extract $>$ 4 m.mhos/cm and ESP $>$ 40.

Conclusions

The salt-affected and normal soils of South Kheri Forest Division vary widely in several morphological, physical and chemical characteristics including texture, calcareousness, presence of indurated pan, pH, EC, ESP and others which are important for plant growth. The salt-affected soils have developed in the plains at lower altitude under the conditions of dry climate and impeded drainage. Forest species have shown varying growth response at different sites depending upon their tolerance. Based upon the results of present investigation, following broad conclusions can be drawn :

(i) All the forest species have failed to grow in $CO_3\text{-}Cl$ type saline-sodic soils which are compact and indurated under impeded drainage conditions and have pH$>$9.5, ESP $>$ 40 and EC $>$ 4 m mhos/cm.

(ii) Improvement of drainage conditions, use of chemical amendments, adopting suitable soil working and planting techniques and also correct choice of tolerant forest species required in saline-sodic soils for proper forest growth in such areas.

(iii) Tendu *(Diospyros tomentosa)*, Dhak *(Butea monosperma)*, Mahua *(Madhuca indica)*, Dudhi *(Wrightia tomentosa)*, Jamun *(Syzygium cumini)* and Rohini *(Mallotus philippinensis)* are able to grow in $Cl\text{-}HCO_3$ type sodic subsoils having a maximum pH value 8.0 EC of saturation extract 4 m mhos/cm at 25°C and ESP 10 in top one metre deep soil but in subsoil tolerance of plants may go up to the values of pH 9.3, ESP 40 and EC 4 m mhos/cm.

(iv) A good growth of sal *(Shorea robusta)* is obtained in well drained nonsaline-non sodic soils having pH near-neutral, EC below 0.2 m mhos/cm and ESP below 3.0.

Acknowledgement

The authors wish to express their sincere thanks to Shri S.H.A. Rizvi, IFS, D.F.O. (Working Plan), South Kheri Forest Division (U.P.) for his generous help during the field investigations.

SUMMARY

A soils investigation was conducted in April, 1979 in some salt-affected and normal soils of South Kheri Forest Division (U.P.) in order to compare (i) saline-sodic soils where all forest species have failed to grow, (ii) sodic soils having fair growth of some tolerant forest species, and (iii) Normal soils having good stand of natural sal forest. These soils vary widely in several morphological, physical and chemical characteristics and accordingly, the forest species have shown varying growth response. In general, all forest species have failed to grow on CO_3–Cl type saline-sodic soils which are compact and indurated with cemented bed of $CaCO_3$ *(kankar)* nodules mixed in clay pan, have drainage donditions very poor, pH>9.5, ESP>40 and EC> 4 m mhos/cm. Few lines on reclamation of these soils have also been suggested. Tendu *(Diospyros tomentosa)*, Dhak *(Butea monosperma)*, Mahua *(Madhuca indica)*, Dudhi *(Wrightia tomentosa)*, Jamun *(Syzygium cumini)* and Rohini *(Mallotus philippinensis)* are able to grow on Cl-HCO_3 type sodic soils having a maximum pH value 8.0, EC of saturation extract 4 m mhos/cm at 25°C and ESP 10 in top one metre deep soil but in subsoil tolerance of plants may go upto the values of pH 9.3, ESP 40 and EC 4. A good growth of sal *(Shorea robusta)* is obtained in well drained nonsaline-nonsodic soils.

दक्षिण खीरी वन मण्डल (उ० प्र०) में वन प्रदेशों के संबन्ध में लवण सोडीय, सोडीय और सामान्य मृदाओं का तुलनात्मक अध्ययन

लेखक के० सिह, एस०के० शर्मा, आर०एम० सिहल, जे०एस० सामरा व एस०डी० शर्मा

सारांश

दक्षिण खीरी वन मण्डल (उ० प्र०) की कुछ लवण प्रभावित और सामान्य मृदाओं में (1) लवण सोडीय मृदाओं, जहां सभी वन वृक्ष जातियां बढ़ने में विफल रही, (2) सोडीय मृदाओं, जहां कतिपय सहनशील वन वृक्ष जातियों की अच्छी बढ़बार है, और (3) सामान्य मृदाओं, जहां प्राकृतिक साल वन अच्छी संख्या में हो रहे हैं, की तुलना करने के लिए अप्रैल 1979 में एक मृदा अन्वेषण किया गया था। इन मृदाओं के कतिपय रचनाकारीय, भौतिक और रासायनिक लवणों में पर्याप्त अन्तर है और तदनुसार वन वृक्ष जातियों ने भी तरह-तरह का वृद्धि प्रतिचार प्रदर्शित किया है। सामान्यत: सभी वन वृक्ष जातियां लवण सोडीय मृदाओं के कार्बोनेटक्लोराइड प्रकार में होने में विफल रही हैं जो अधिक निविड़ और चिकनी मिट्टी के दृढ़ स्तर में मिले कैल्सियम कार्बोनेट (कंकर) से जुड़े हुए स्तर से जरठ बनी होती है उनमें जन निश्चारण की दशाएं भी घटिया होती है, पी एच>9.5, विनियम सोडियम प्रतिशत> 40 और विद्युत चालकता > 4 एम महोस/सेंमी०। नन मृदाओं के सुधार के विषय में भी कुछ दिशाएं सुझाई गयी हैं। हाइपोक्लोराइड प्रकार की सोडीय मृदाओं में जिनका पी एच मान अधिकतम 8.0, संतृप्ति निस्सार की 25° से० पर विद्युतचालकता 4 मी० महोस/सेंमी०, मृदा के ऊपरी 1 मी० स्तर में विनियम सोडियम% 10 थी, तिन्दु (डायोसपायरस टोमेनटोसा) ढाक (ब्यूटिआ मोनोस्पर्मा) महुआ (मधुका इण्डिका), दूधी (राइटिया टोमेनटोसा) जामुन (साइजीजियम क्यूमिनाई) और रोहिणी (मैलोटस फिलीपाइनैंसिस) हो जाते हैं परन्तु अधोमृदाओं में सहयता पीएच 9.3, विनियम सोडियम प्रतिशत 40 और विधुत चालकता 4 तक पहुंच सकती है। सुनिश्चारित गैर-लवण गैर-सोडीय मृदा में साल (शोरिया रोबस्टा) बड़ी अच्छी तरह होता है।

References

Agarwal, R.R. and J.S.P. Yadav (1956). Salinity and alkali scale to evaluate saline alkali soils for crop production. *J. Indian Soc. Soil Sc.* 4 : 141-45.

Black, C A. (1965). Method of soil analysis (Pt. II). American Society of Agronomy, Inc., Publisher Madison, Wisconsin, U.S.A.

Chandra, G. (1972). Working Plan for the South Kheri Forest Division, Central Circle (U.P.) 1970-71 to 1979-80.

Dalal, S.S. (1980). Afforestation of salt-affected soils in Haryana. Presented at 'Second Forestry Conference' held at F.R.I. & Colleges, Dehra Dun during 16-19th Jan., 1980.

Ghosh, R.C. (1977). Hand Book on Afforestation Techniques. Controller of Publications, Delhi.

Lohani, D.N. (1978). Usar Afforestation and use of soil amendments. Proc. 'Use of Sedimentary Pyrites in reclamation of alkali soils' of FAI–Deptt. Agriculture (U.P.) 194–199.

Luthra, K.L. (1980). 'Crop production is possible in salt–affected soils too'. Hindustan (Hindi) dated 20th August.

Malcolm, C.V.; T.C. Swaan, and H.T. Ridings (1980). Niche seeding for broad scale forage shrub establishment on saline soil. Int. symp. on salt–affected soils held at CSSRI, Karnal during 18–21st February.

Pande, G C. (1967). Afforestation of Usar lands. Proc. XI Silviculture Conference held at F.R.I. & Colleges, Dehra Dun during 15–25th May.

Piper, C.S. (1944). Soil and Plant Analysis. The University of Adelaide, Australia.

Richard, L.A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. *U S.D.A. Hand Book* No. 60, Washington.

Samara, J.S., R.M. Singhal, K. Singh and S.D. Sharma, (1980). Some degraded and denuded habitats of South Kheri Forest Division (U.P.) and their management. Presented at "National Symp. on Soil Conservation and Water Management in 1980's". held at C.S.W.C.R. & T. Institute, Dehra Dun during 12–13th March.

Yadav, J.S.P. (1979). Reclamation of salt-affected soils Presented at "Indo-Hungarian Seminar on Management of Salt-affected Soils" held at CSSRI, Karnal, February.

Yadav, J.S.P. (1980). Salt-affected soils and their afforestation. Presented at "Second Forestry Conference" held at F.R.I. and Colleges, Dehra Dun during 16–19th Jan.

Yadav, J.S.P. and K. Singh (1970). Tolerance of certain forest species to varying degree of salinity and alkali. *Indian For.* 96 : 587–99.

Yadav, J.S.P. and B.M. Sharma (1976). Soils changes in differently treated planting pits under *Eucalyptus* hybrid in a saline-sodic soil. *Agrokemia Talajtan* 25 : 327–38.

———

LABORATORY EVALUATION OF SOME INSECTICIDES AGAINST THIRD INSTAR LARVAE OF *SELEPA CELTIS* MOORE (NOCTUIDAE : LEPIDOPTERA)

B.K. GUPTA, VIJAY VEER AND P.K. SEN-SARMA

Forest Entomology Branch,
Directorate of Biological Research,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Selepa celtis Moore is a widespread and polyphagous defoliator. Some important host tree are *Morus alba, Bischofia javanica, Careya arborca, Elaeodendron qluacum, Ficus racemosa, Gmelina arborea, Duabanga grandiflora, Lagerstroemia speciosa, Shorea robusta, Terminalia* spp., *Xylia xylocarpa* and *Stereospermum suaveolens*. Severe infestation causes complete defoliation in some trees (Beeson, 1941), the maximum defoliation occurring from July to September. On account of increasing forest areas coming under plantation mostly comprising of a single species, insecticidal spraying is often recommended. To determine the minimum effective dose of an appropriate insecticide, bioassay of available insecticides is being carried out against various-defoliators of forest tree species. The results of bioassay of insecticides on some other forest tree defoliators have been given by Singh and Gupta (1978a, 1978b), and Sen-sarma *et al.* (1982). In the present study, 21 commonly available insecticides were bioassayed against 3rd instar larvae of *Selepa celtis* under room temperature. The test insects were reared on leaves of *Morus alba.*

Material and methods

Twenty-one insecticides were tested as contact poisons using 3rd instar larvae of *Selepa celtis* as test material. The insecticides tested were : monocrotophos 100 EC, chlordimeform 50 EC, quinalphos 55 EC, anthio 35 EC, carbaryl 50 WP, endosulfan 35 EC, pyrethrum 2 EC, gamma-BHC 20 EC, dichlorvos 50 WDP, toxaphene 80 EC, leptophos 34 EC, malathion 50 EC, klofos 50 EC, fenitrothion 50 EC, dieldrin 18 EC, aldrin 30 EC, cythion 50 EC, DDT 50 WP, accothion 500 EC, dimethoate 30 EC, and endrin 20 EC. Different concentrations (varying from 5-7) of a given insecticide were obtained by diluting it with tap water, while in controls only tap water was sprayed on the leaves (food). Thirty active and similar-sized larvae were taken out from the laboratory culture and apportioned randomly into three batches, each comprising of 10 larvae to get three replications, for each concentration of insecticide. Each batch of larvae was sprayed with 2 ml of each dose of the insecticide under the Potter's Tower at 24 cm Hg pressure in a Petri dish. The insecticide sprayed on the larve was dried under an electric fan after which the sprayed larvae were transferred to a chimney cage having fresh leaves of *Morus alba.* The upper part of each chimney cage was covered with a fine wire-mesh lid. Mortality, both in sprayed and unsprayed larvae, was noted after 24 hours. The relative toxicity of different insecticides in terms of Lc 50 value of DDT as one was calculated by probit analysis (Finney, 1952).

Table 1

Relative toxicity of different insecticides (arranged in the descending order of their toxicity) to 3rd instar larvae of Setepa celtis Moore.

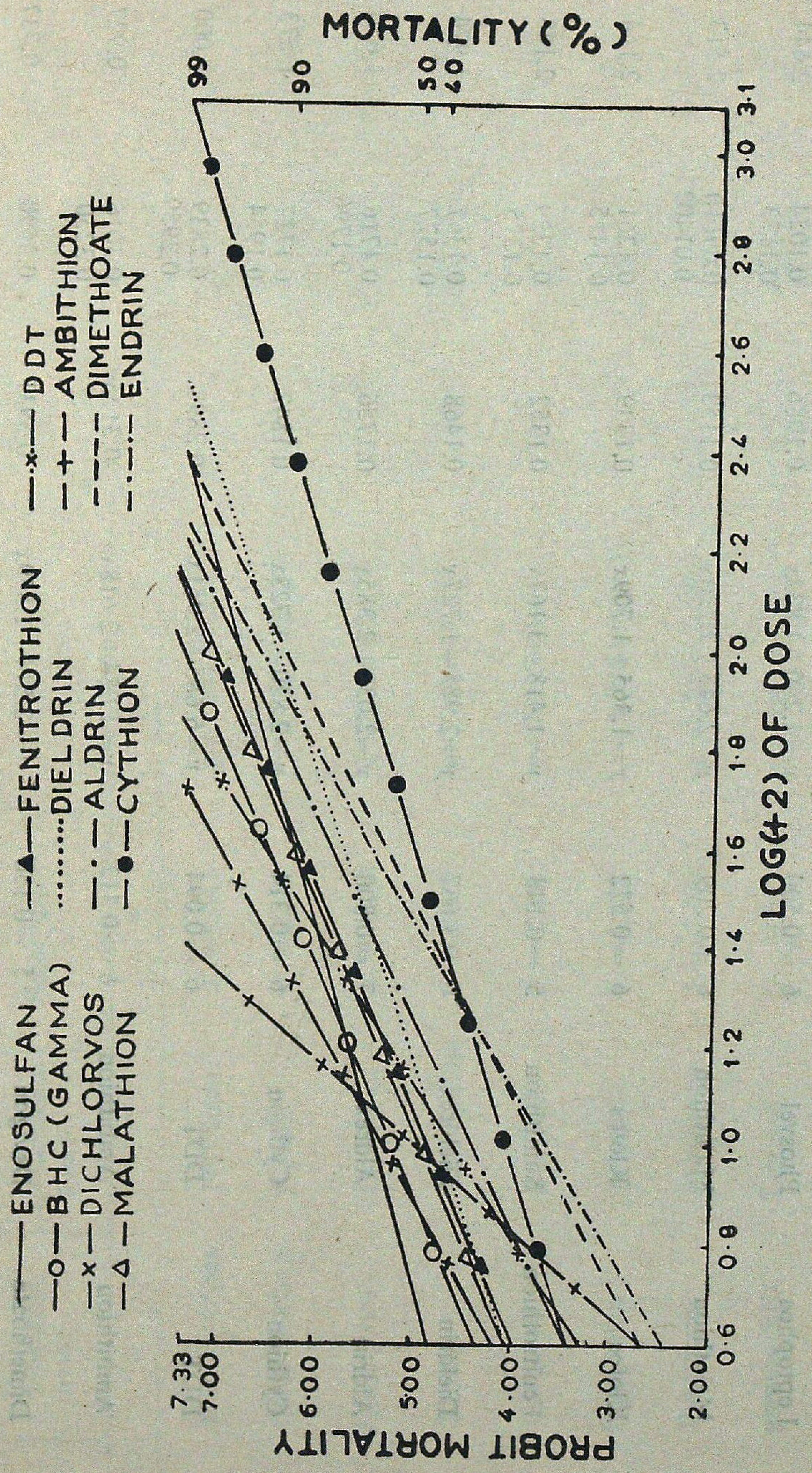
S.No.	Common name	Commercial name	Heterogenity X^2	Regression equation	Lc 50	Fiducial limits	Relative toxicity
1	2	3	4	5	6	7	8
1.	Monocrotophs	Nuvacron	5 =1.543	$y=0.251+4.508x$	0.01131	0.01120 0.21140	25.623
2.	Chlordimeform	Fundal	5 =0.341	$y=1.463+3.141x$	3.01307	0.01283 0.01331	22.172
3.	Quinalphos	Ekalux-25	5 =0.130	$y=2.860+1.834x$	0 0.469	0.01376 0.01566	19.727
4.	Anthio	Formothion	5 =0.625	$y=1.065+3.198x$	0.01672	0.01653 0.01752	17.260
5.	Carbaryl	Devicarb	5 =0.158	$y=2.755+1.470x$	0.03360	0.03142 0.33607	8.601
6.	Endosulfan	Thiodan	6 =1.826	$y=3.395+2.343x$	0.04842	0.04774 0.04909	5.985
7.	Pyrethrum	Pyrethrum	5 =0.400	$y=0.852+2.389x$	0.05448	0.05264 0.05636	5.319
8.	gamma-BHC	Lindane	6 =0.341	$y=2.441+2.856x$	0.07870	0.07739 0.08002	3.682
9.	Dichlorvos	Nuvan	6 =0.355	$y=3.098+2.076x$	0.08283	0.07971 0.08523	3.498

(Contd)

1	2	3	4	5	6	7	8
10.	Toxaphene	Autox	6 =1.576	$y=1.536+1.734x$	0.09945	0.09309 0.01062	2.914
11.	Leptophos	Phosvel	6 =0.500	$y=1.260+1.833x$	0.1086	0.1024 0.1173	2.644
12.	Malathion	Malathion	6 =0.209	$y=2.643+2.220x$	0.1153	0.09610 0.01402	2.513
13.	Klofos	Klofos	6 =0.572	$y=1.365+1.709x$	0.1339	0 1261 0.1415	2.164
14.	Fenitrothion	Sumithion	5 =0.148	$y=1.418+3.167x$	0.1352	0.1329 0.1375	2.143
15.	Dieldrin	Dieldrex	6 =3.667	$y=2.985+1.727x$	0.1468	0.1367 0.1577	1.974
16.	Aldrin	Aldrex	7 =0.800	$y=2.032+2.385x$	0.1756	0.1716 0.1796	1.650
17.	Cythion	Cythion	6 =0.314	$y=2.820+1.723x$	0.1842	0.1737 0.1954	1.573
18.	DDT	DDT	6 =0.094	$y=6.685+2.951x$	0 2898	0.2839 0.2959	1.000
19.	Ambithion	Ambithion	6 =0.312	$y=1.084+2.618x$	0.3125	0.3016 0.3250	0.927
20.	Dimethoate	Devigon	5 =0.130	$y=2.514+1.559x$	0 3931	0.3590	0.737
21.	Endrin	Endrin	5 =0.08	$y=(-0.740)+5.768x$	0.0988	0.0977 0.1009	0.292

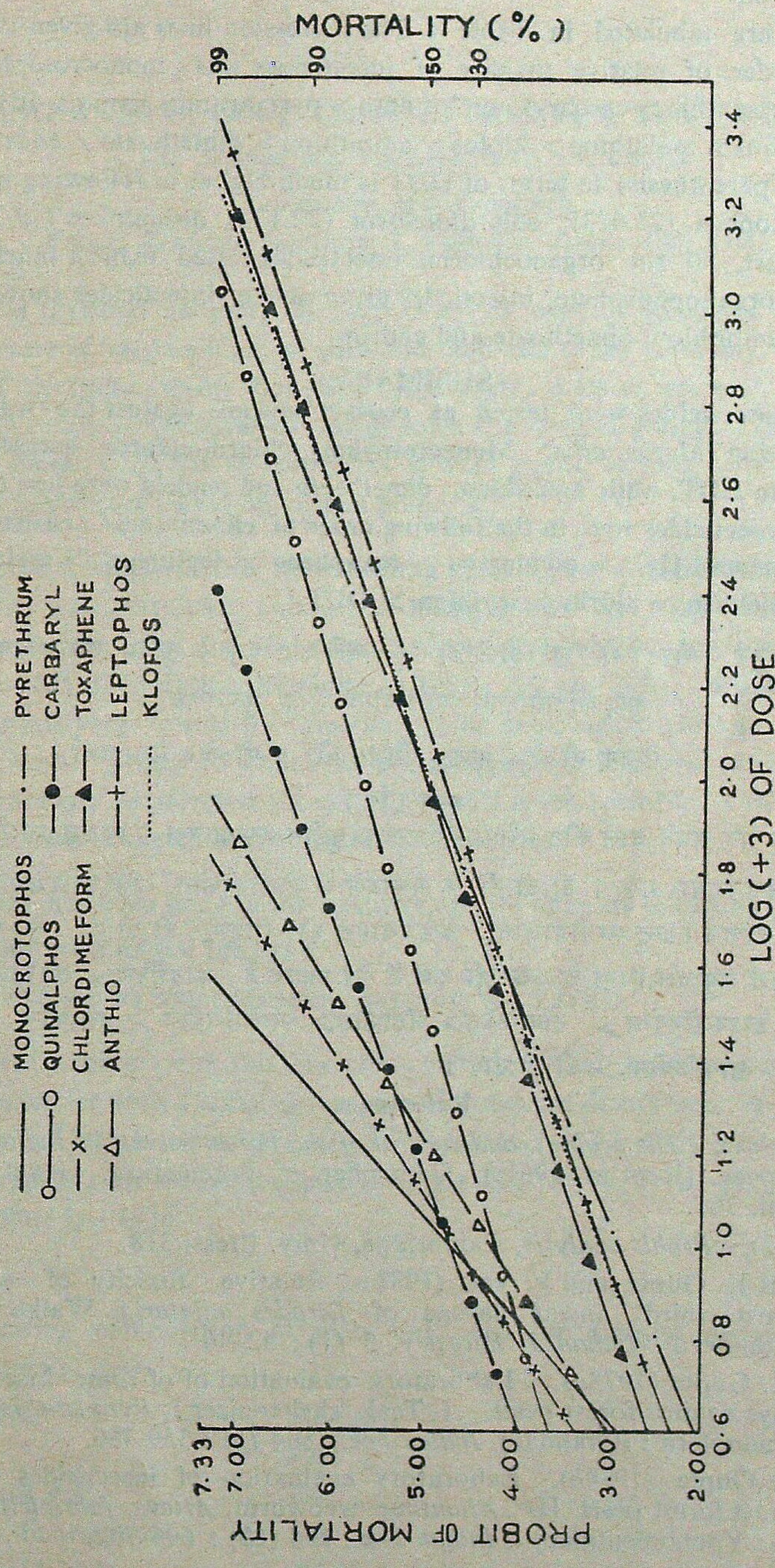
In none of the cases, the data found to be heterogenous at P=0.05, y=Probit kill, x=Log concentration,
Lc 50= Concentration calculated to give 50% mortality.

Fig. 1



Regression lines for sprayed insecticides

Fig. 2



Regression lines for sprayed insecticides

Results and discussion

The results are tabulated in Table I. The regression lines are given in Figs. 1 and 2. The descending order of relative toxicity of insecticides was : monocrotophos> chlordimeform> quinalphos>anthio> carbaryl>endosulfan> pyrethrum> gamma-BHC> dichlorvos toxaphene> leptophos> malathion> klofos> ambithion> dimethoate 7 endrin. The ralative toxicity (given in parenthesis) in terms of DDT is much higher in following insecticides than the rest : monocrotophos (25.623), chlordimeform (22.172) ,quinalphos (19.727) and anthio (17.260). In contrast, all the organochlorine insecticides tested exhibit much lower relative toxicity than the organophosphate insecticdes given above. Insecticides showing less toxicity than the DDT are ambithion, dimethoate and endrin.

SUMMARY

Twenty-one insecticides were tested as contact poisons against the 3rd instar larvae of *Selepa celtis* infesting *Morus alba.* Monocrotophos, chlordimeform, quinalphos and anthio were more toxic than DDT, while ambithion, dimetheate and endrin were less toxic than DDT. The rest of the 14 insecticides were in the follwing order of effectiveness : carbaryl> endosulfan > pyrethrum >gamma-BHC > dichlorvos > toxaphene > leptophos > malathion > klofos > fenitrothion > dieldrin > aldrin > cythion > DDT.

सेलेपा सैल्टिस मूर (नौक्टुइडी : लेपिडोप्टेरा) (=शलिकपक्षा:) के तृतीय रूप जातक के विरुद्ध

कुछ कीटनाशियों का प्रयोगशालिक मूल्यांकन

लेखक बी०के० गुप्त, विजय वीर व पी०के० सेन-शर्मा

सारांश

मोरस एल्बा पर लगने वाले कीट सेलेपा सैल्टिस के तृतीय रूप जातक के विरुद्ध स्पर्श विष के रूप में 21 कीटनाशियों का परीक्षण किया गया। डी.डी.टी. के मुकाबले में मोनोक्रोफोस, क्लोरडाइमेफार्म, क्विनलफोस और एन्थियो अधिक विषैले निकले किन्तु एम्बीथाआन, डाइमेथोएट और एंड्रिन, डी.डी.टी. से कम विषैले निकले। शेष 14 कीटनाशी पदार्थ प्रभावशालिता के अवरोही क्रम में इस प्रकार हैं कार्बारिल> एंडोसल्फान> पायरेथ्रम> गामा बी एच सी > डाइक्लोरवोस> टोक्साफेन> लेटोफोस> मालाथियोन > क्लोफोन्स > फेनिट्रोथियोन> डीलिड्रन > एलिड्रन > सायथियोन > डी.डी.टी.।

References

Beeson, C.F.C. (1941). *The ecology and control of the Forest insects of India and neighbouring countries.* (Reprint, 1961.), Controller of Publication, Government of India, Delhi, 767.

Finney, D.J (1952). *Probit analysis*, Cambridge, Univ. Press, 318.

Sen-sarma, P.K., B.K. Gupta and V. Veer (1982). Relative toxicity of some insecticides against third instar larvae of *Dirades adjntaria* Walkar (Epiplemidae : Lepidoptera) *Indian J. Forestry.* 5 (1) : 42–46.

Singh, P. and B.K. Gupta (1978*a*). Laboratory evaluation of of some insecticides as contact sprays against forest pests. I. Teak skeletonizer : *Pyrausta machaeralis* Walker (Lepidoptera : Pyralidae). *Indian For.*, **104** (5) : 359-366.

Singh, P and B K. Gupta (1978*b*). Laboratory evaluation of insecticides as contact sprays against forest pests. II. *Alianthus* webworm, *Atteva fabriciella* Swed. (Lepidoptera : Yponomeutidae). *Indian For.*, **104** (10) : 696-702.

HOT SETTING ANIMAL GLUE COMPOSITION FOR TEA-CHEST PLYWOOD

R.C. GUPTA, M.S. RAJAWAT AND J.K. BAGGA

Composite Wood Branch,
Forest Research Institute & Colleges, Dehra Dun (India)

The Indian plywood industry is very much in need of adhesives which could be used for the manufacture of various kinds of plywood and add to its economy. Since in the recent past the cost of synthetic resins has risen enormously, a lot of research work is going on in this field to find out alternatives to bring down the cost of gluing. The present work was initiated with a similar objective to reduce the cost of gluing in making the tea-chest plywood using adhesive composition based on animal glue.

Animal glue is water soluble, jelly forming protein glue which is obtained by mild steam hydrolysis of the water insoluble collogen of hides, sinews and bone marrow of cattle. This glue is the oldest known glue having records of its use over 3000 years ago. This glue gives good bonds provided the relative humidity is below 80 per cent. Besides this its pot life at room temperature is very low as the glue has to be kept warm while gluing otherwise it will set rapidly. It is also prone to attack by micro-organisms in course of time. Though it has got some disadvantages as narrated above yet it is still much useful for various kinds of joinery work. It is also used in match and ammunition industries.

Much work has been done in the past to improve upon its following properties :

(i) to improve its pot life, and

(ii) to increase its water resistance property (1, 3 & 4).

The present work done in this direction indicates that animal glue along with paddy husk gel as an extender with a small percentage of Potasium dichromate and paraformaldehyde gives a composition which when pressed at about 100°C (± 5°C) produces plywood which meets the requirements for tea-chest plywood as per IS : 10 (Part II)– 1976 and its tea chests as per IS : 10 (Part I)—1976.

Experimental

The following composition of glue was used for making plywood for tea-chests as suggested by Gupta (1961).

Animal glue	—	100 parts
Water	—	300 ,,
Paddy husk gel	—	200 ,,
Potasium dichromate	—	1 ,,
Paraformaldehyde	—	5 ,,

Plywood boards having a thickness of 4.2 ± 0.2 mm were prepared from veneers of *Dipterocarpus turbinatus* (Gurjan) at the following conditions :

Glue spread	—	16 gms/1000 cm^2
Pressure	—	14 kg/cm^2
Temperature	—	100 ± 5°C
Time of pressing	—	10 minutes

Plywood so obtained was then tested as per IS : 10 (Part II) 1976 for making the tea-chests. The results obtained have been given in Table 1.

Since the plywood was found satisfactory, big size plywood panels were prepared for making tea-chests from the same species i.e., *Dipterocarpus turbinatus* and with the same glue composition. The size of the tea-chest prepared was :

60 × 50 × 40 cm of thickness 4.2 mm with permissible tolerance of ± 0.2 mm.

Table 1

Test results of plywoed prepared with Animal glue extended with Paddy husk gel.

Sl. No.	Glue Adhesion strength (dry)		7 Days cold water soaking
	F.L. (kg)	% G.F.	
1.	127	100	Sound
2.	96	100	Sound
3.	147	100	Sound
4.	134	100	Sound
Requirement as per IS : 10 (Part II)-1976	70	—	Shall not delaminate more than 5 cm all round,

Table 2

Test results of tea-chests

Sl. No.	Average moisture content (%)	End compression test Maximum load (kg)	Corner drop test Maximum height (cm)
1,	11,4	6840	75
2.	12.6	7410	75
3.	10.7	7410	60
4.	9.6	8550	75
5.	10.2	7410	45
IS : 10 (Part I)-1976	15.0	5500	100

Ten tea-chests of the above size were prepared which were then fully packed with dry sawdust tested as per IS : 10 (Part I) – 61976. The average results obtained have been depicted in Table 2.

Results and discussion

The results depicted in Table 1 indicate that the glue adhesion strength is fairly above the requirements of plywood for tea-chests as per IS : 10 (Part II) – 1976. Table 2 indicates that as far as the end compression test is concerned, the results are quite satisfactory so as to meet the requirements for tea-chests as per IS : 10 (Part I)— 1976. However, in the corner drop test, the maximum height for drops has reached only upto 75 cm. The reason for it may be the high percentage of glue failure as indicated in Table 1. However, it is possible that other species of timber might give better performance and further experiments in this direction are needed.

The hot set composition of gluing, based on Animal glue which has been suggested here has the advantage over the Urea-formaldehyde based composition of reducing the cost of gluing to about 25 per cent.

However, this would require initially an arrangement for hot pressing, but simultaneously this would increase the rate of production also which would be another advantage of major significance to the tea-chest producing units.

SUMMARY

The paper incorporates the results obtained using a hot setting animal glue composition for tea-chest plywood. The results indicate that the glue composition suggested here is satisfactory for making tea-chests and could meet their requirements as per IS : 10 (Part I) 1976. The suggested method envisages a reduction in the cost of gluing to about 25 per cent against the cost of gluing using Urea-formaldehyde.

चाय पेटियों के स्तरकाष्ठ के लिए गर्मस्थायी प्राणिजश्लेण संगठन

लेखक आर०सी० गुप्त, एम०एस० राजावत व जे०के० बग्गा

सारांश

इस अभिपत्र में चाय पेटियों का स्तरकाष्ठ बनाने में प्रयुक्त किए गर्मस्थायी प्राणिजश्लेष से मिले हुए परिणामों को दिया गया है। परिणामों से संकेत मिलता है कि यहां पर सुझाया गया श्लेष संगठन आई०एस० : 10 (भाग 1) 1,76 के अनुसार सन्तोषप्रद है। प्रस्तावित रीति से श्लेष निर्माण की लागत से युरिजा-फार्मेल्डिहाइड उपयोग में लाकर बनाए गए श्लेष की लागत की तुलना में लगभग 25 प्रतिशत की कमी हो जाती है।

References

Gupta, R.C. (1961). Agra University, *Ph.D. Thesis.*

Narayanamurti, D. and R.C. Gupta (1959). *Composite Wood* 6, 7.

Roy, D.C. and P. Naha (1972). *IPIRI Journal*, 2 (3 & 4).

Sud, Ajit Singh and Ravindra Goyal (1963). *Plywood* 8, 3.

CROWN DEVELOPMENT OF *CEDRUS DEODARA*

S.P. SINGH*

Asstt. Silviculturist (Plan Studies)

Forest Research Institute & Colleges, Dehra Dun (India)

Tree crown is correlated with tree size. Largest trees generally have largest and healthy crown, while small trees show small crowns. This relationship has drawn attention of foresters from time to time in quest of discerning some meaningful relationship with growth of a tree or stand as healthy foliage available for assimilation activity contribute towards growth of a tree. But respiration losses from large crowns are also heavy and influenced by other factors like environment, soil etc., thus making the problem more complex. Further assimilation capacity varies with age; it decreases with maturity. That is why the impact of research efforts to predict growth and yield estimation of a stand is yet to be felt. The difficulty of crown size measurement or classifying it into crown sizes speedily and in unbiased manner, is another hurdle, and it if felt that traditional methods of yield estimation and now with the concept of variable density yield tables based on diameter, height, site index, age and number of trees per hectare will continue to dominate the field.

But there are other management objectives where study based on crown development can serve useful purpose. At 100 per cent level of stocking, stands of same diameter at breast height may contain relatively few trees, having wide crown or hold dense trees of restricted crowns. Crown studies can help in setting a limit to minimum number of trees per hectare required to stock an area. This would be useful when capital and seedlings rather than land area are limited, in such case it is better to plant bare minimum trees/ha to stock the site rather than attempting intensive managmeent in smaller area. Such a situation would arise in very near future in Himalayas where vast tract of denuded hills threatened by erosion warrant clothing up in shortest possible time, but to generate resource and planting stock for such a big task readily would be difficult. By excercising suitable control on crown size, it is also possible to grow log size trees free from knots and defects to enhance tree value. Secondly data on open grown trees can help in planning establishment of seed production areas and management of seed orchards because fruiting is related to crown size and other crown characters. Thirdly as density of crop greatly influences crown development, its study may serve a guide for thinnings. Vezina (1964) used his data on crown development as a guide to formulate thinning regimes for balsam fir in Quebec.

In view of its important role in attaining some specific management objectives, the crown development studies of *Cedrus deodara* (deodar) occurring in Chakrata Forest Division

*Present address: Project Director, Land Survey Directorate, 245 Basant Bihar, Dehra Dun.

of Uttar Pradesh were undertaken. In all, 261 tree measurements were studied, which were removed from 31 stocked sample plots maintained at C/D grade of thinnings. The following gives an indication about the range of data :

		Denoted in text by
Age (yrs)	52 to 151	A
Height (m)	14.2 to 41.1	H
Diameter at breast height (cm)	9.9 to 65.5	D
Crown width	1.83 to 9.45	C

The program to develop regression was run on IBM 370/145 computor and a combination of 21 independent variables were used in stepwise multiple regression. The variables were :

$$C,\ \log(D+1),\ D^2,\ [\log(D+1)]^2,\ A,\ A\log(D+1),\ AD,\ AD^2,\ D^2\log(D+1),\ H\log(D+1),\ HD,\ HD^2,\ D[\log(D+1)]^2,\ HA,\ AH\log(D+1),\ AHD,\ AHD^2,\ D^2[\log(D+1)]^2\ D,\ \&\ H$$

0.001 was fixed as proportion of sum of square to limit intering of variable into regression. The following regression was thus obtained :

$$C = 2.439627 - .004407\,A + .047465\,D\,[\log(.393703\,D + 1)]^2$$

Determination Coefficient $r^2 = .686$

Residual standard deviation $= .7160$

Under prevalent management practice the relationship between crown width and diameter at breast height at different ages is revealed by above relationship (Table 1). For triangular spacement which even plantations tend to acquire with the passage of time, number of trees/ha (N) equals

$$N = \frac{10000}{C^2 \times .866}$$

This analysis, thus could yield a numeric thinning guide to foresters (Table 2).

The value of determination coefficient is on lower side. It implies that for same age and diameter, crown width varies substantially indicating that a crop can remain fully stocked over wide range of fluctuation in number of trees per hectare. Approximate limits to these range is imposed by residual standard deviation.

At 5% level of confidence it would approximate to estimated $C \pm 2.0 \times$ Residual standard deviation.

Table 3 has been generated which gives minimum number of trees/ha which could cover the site without break in canopy. This estimate does not appear to be on lower side because it is based on tree growing in stocked conditions and trees if given a chance to grow in open would produce bigger crowns than the best produced under stocked conditions.

It is hoped that these Tables would serve as guide in establishment of seed orchards, seed stands and afforestation work in soil conservation schemes in the hills.

Table 1

Corwn width in metres

Diameters at breast height (cm)	Age in years						
	20	40	60	80	100	120	140
5	2.40	2.32	2.23	2.14	2.05	1.96	1.88
10	2.58	2.49	2.40	2.32	2.23	2.14	2.05
15	2.85	2.77	2.68	2.59	2.50	2.41	2.32
20	3.21	3.12	3.03	2.94	2.85	2.76	2.68
25	3.62	3.54	3.45	3.36	3.27	3.18	3.09
30	4.10	4.01	3.92	3.83	3.75	3.66	3.57
35	4.62	4.54	4.45	4.36	4.27	4.18	4.10
40	5.20	5.11	5.02	4.93	4.84	4.76	4 67
45	5.81	5.72	5.63	5.55	5.46	5.37	5.28
50	6.46	6.37	6.28	6.20	6.11	6.02	5.93

Table 2

No. of trees/ha (for normal density)

Diameters at breast height (cm)	Age in years						
	20	40	60	80	100	120	140
5	2005	2145	2322	2521	2748	3006	3267
10	1735	1862	2005	2145	2322	2521	2748
15	1422	1505	1608	1722	1848	1988	2145
20	1121	1186	1258	1336	1422	1576	1608
25	881	921	970	1023	1080	1142	1209
30	687	718	751	787	821	862	906
35	541	560	583	607	633	661	687
40	427	442	458	475	493	510	529
45	342	353	364	375	387	400	414
50	277	285	293	300	309	319	328

Table 3

Minimum No. of trees/ha (for full canopy coverage)

Diameters at breast height (cm)	Age in years						
	20	40	60	80	100	120	140
5	787	821	862	906	954	1005	1054
10	718	751	787	821	862	906	954
15	630	655	684	715	748	783	821
20	536	558	581	605	630	658	686
25	453	467	485	503	523	543	562
30	378	390	403	417	430	446	462
35	315	324	334	344	355	366	378
40	263	270	278	285	294	301	310
45	220	226	232	237	243	250	256
50	185	190	194	198	203	208	213

SUMMARY

Crown development of trees in stands is a facinating study. Though its application in growth and yield estimation may not be simple but it may serve useful purpose in some specific management objectives like establishment of seed production areas and management of seed orchards, guide for thinnings etc. With the help regression developed for *Cedrus deodara* (deodar) tabular statements have been generated to predict crown width, number of trees/ha for normal density stands and minimum number of trees/ha for full canopy coverage.

सीडरस डिओडारा का छत्र विकास

लेखक एस०पी० सिंह

सारांश

खड़े वनों में वृक्षों का छत्र विकास बहुत रोमांचक अध्ययन है। भले ही वृद्धि और प्राप्ति का आकलन करने में उसका उपयोग सरल न हो परन्तु बीज उत्पादन क्षेत्रों की स्थापना और बीज-उद्यानों का प्रबन्ध, विरलन के लिए मार्गदर्शन आदि जैसे विशिष्ट प्रबन्ध उद्देश्यों के लिए यह उपयोग प्रयोजनों की सिद्धि कर सकता है। सीडरस डिओडारा (देवदारु) के लिए विकसित किए हुए प्रतीपायन की सहायता से, छत्र की चौड़ाई, सामान्य सघनता वाले वनों में वृक्ष संख्या/हेक्टेयर और पूर्ण वितान आवरण के लिए न्यूनयम वृक्ष संख्या/हेक्टेयर की पूर्व सूचना देने के लिए सारणीबद्ध विवरण भी तैयार किए गए हैं ।

References

Assmann, E. (1970). The Principals of forest yield study, Pergamon Press, Oxford.

Dahmos, Walter G. (1966). Relationship of lodge pine volume increment to Crown Competition Factor, Basal Area, Site index, *Forest Science*, 12 (1).

Krajicek, John E., A. Kenneth Brinkman, F. Samuel Gringrich (1961). Crown Competition; A measure of density, *Forest Science*, 7 (1).

Loetsch, F., F. Johrer, K.E. Haller (1973). *Forest Inventory* Vol. II, BLV Verlagsgesellschaft Munchen Bern Vien.

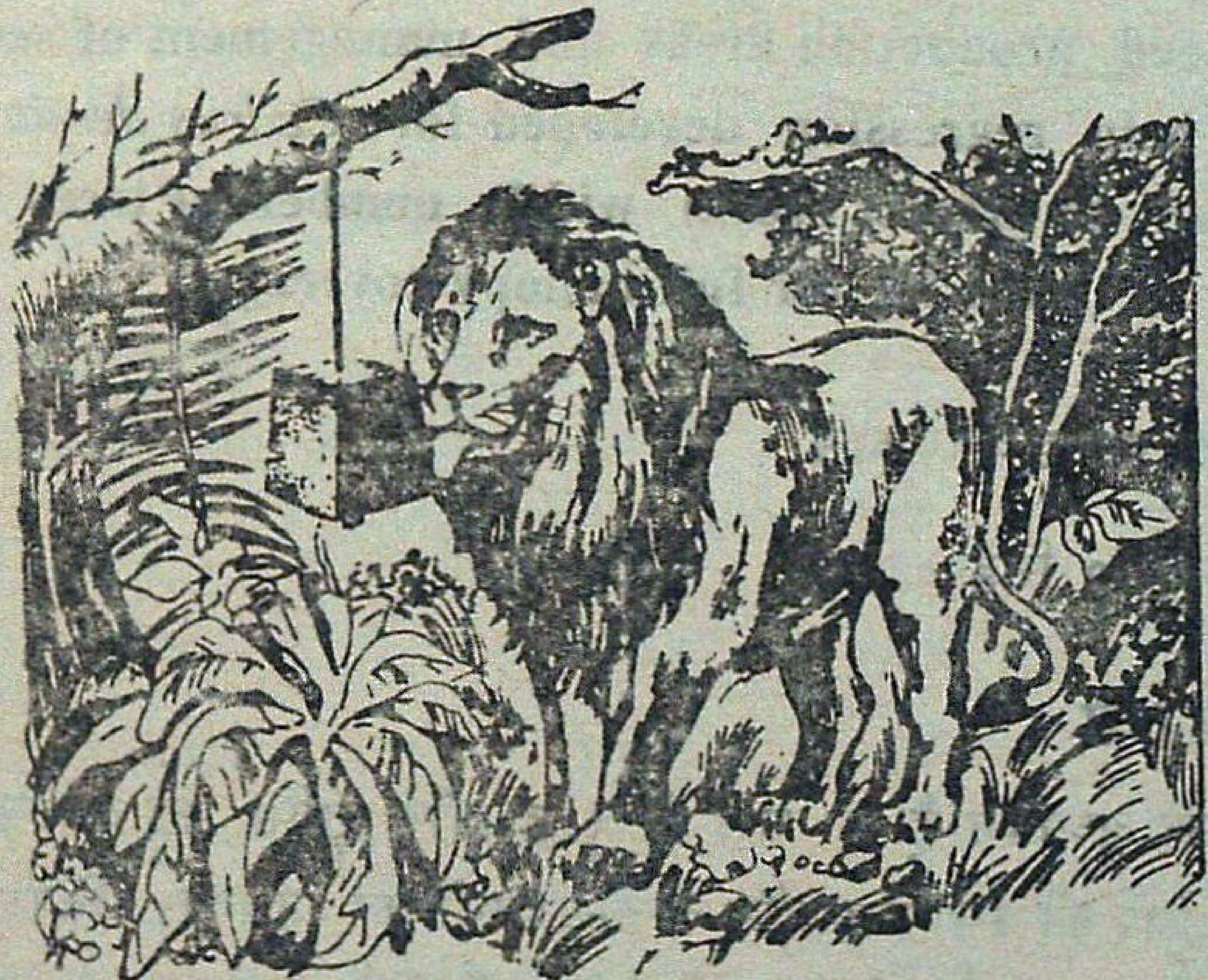
Vezina, P.E. (1963). More about the Crown Competition Factor, *Forestry Chronicle,* 39 (3).

Williams, E.J. (1959). *Regression Analysis,* John Wiley and Sons, Inc., New York, London, Sydney.

———

MONOLICK® SALT LICK

makes wild Animals Healthier



In natural habitat wild-life often suffers from inadequacy of salt in the forests. Animals lick ground or impure rocks for salt intake and develop diseases. Result – high mortality.

Now, world over, SALT LICKS have been designed to supplement this deficiency. India and in adjacent countries, **MONOLICK SALT LICK** has long been introduced, is highly effective for disease prevention, and for growth stimulation

* The easy and economical way of providing primary nutrient 'pure salt' to animals.
* Picking points for locating wild animals.
* Harnessing licking habits for health and lower mortality rate

Manufacturers

MUHANA COMPANY

SHEGAON (C. Rly.) India

MUHANA

Goldfields

SCHEFFLERA HOI (DUNN) VIGUIER (ARALIACEAE)—A TREE NEW TO INDIA

H.B. NAITHANI AND S.S.R. BENNET

Systematic Botany Branch,
Directorate of Biological Research,
Forest Research Institute and Colleges, Dehra Dun (India)

In the course of exploration tours undertaken during 1977-78 in Kameng district Arunachal Pradesh (NEFA), the authors collected some specimens from a tree of *Schefflera* in Peri La Mountain. After critical examination these did not match with any of the Indian species. Therefore, a specimen was sent to the Gray Herbarium of Harvard University, Massachusetts, U.S.A. and there it was identified by Dr. Stevens as *Schefflera hoi* (Dunn) Viguier. This species was first described by Dunn (1903), based on Dr. Henry's collection from south of Red River, Yunnan (China) under the genus *Heptapleurum.* Later in 1909, Viguier transferred it to the genus *Schefflera.* W.W. Smith in 1907 described a species, *Schefflera salweenensis*, from Yunnan (China), which according to Hui-Lin Li (1942) is a synonym of *S. hoi.* There is no other record of the occurrence of this taxon from anywhere else. It is now being reported for the first time from India. To facilitate the identification, a detailed description alongwith photographs is provided.

Schefflera hoi (Dunn) Viguier, Ann. Sci. Nat. 9 Bot. 9 : 333. 1909; Li, Sargentia 2 : 30. 1942. *Heptapleurum hoi* Dunn, J. Linn. Soc. Bot. 35 : 498. 1903. *S. salweenensis* W.W. Smith, Notes Roy, Bot. Gard. Edinb. 10 : 64. 1917 & 14 : 208. 1924.

A tree 5-15 m high, bark dull white. *Leaves* 3-7-foliolate; petiole terete, glabrous, 10-30 cm long; leaflets oblong to oblanceolate, subcoriaceous, glabrous above, glaucous beneath, 5-18 × 2.5-7 cm, apex acute or acuminate, base rounded to cuneate, margin entire or sometimes revolute; petiolules glabrous, 1-5 cm long. *Inflorescence* a large terminal panicle, 40-50 cm long, ferruginous-tomentose to glabrescent; flowers recemosely arranged on the lateral branches, cream coloured; bracts triangular, 5 mm long; pedicels 2-3 mm long, ferruginous-tomentose; bracteoles small, pointed, less than 1 mm long. *Calyx* sparsely ferruginous-tementose to white tomentose, inconspicuously 5-dentate. *Petals* glabrous, 1.5-2 mm long, creamish. *Stamens* 5, filaments almost equalling the petals. *Ovary* 5-celled; styles connate into a column, in fruit ca 1.5 mm long; stigmas indistinct, in fruit distinct and capitate. *Disk* flat, in fruit ca 2 mm across. *Fruit* globose, glabrous, 4.5 mm across, inconspicuously 5-angular.

Specimens examined

Peri La, Kameng district, 2400 m, 15.10.1977, *Bennet & Naithani* 3035 (DD); Peri La, Kameng district, 2200 m, 20.10.1978, *Sahni & Naithani* Ser. II. No. 824 (DD).

Distribution : Yunnan in China and Arunachal Pradesh in India.

Acknowledgements

Acknowledgement is made to Shri E.S. Thamgam, I.F.S., Chief Conservator of Forests, Arunachal Pradesh for facilities in field work and to Dr. Peter F. Stevens, Gray Herbarium, U.S.A. for the indetification of the specimen.

SUMMARY

Schefflera hoi **(Dunn) Viguier, a tree native of China, is reported here for the first time from Arunachal Pradesh in India.**

भारत के लिए नया वृक्ष शेफ्फ्लेरा होई (डन्न) विगुए (एरेलियेसी=तापमारी कुल)

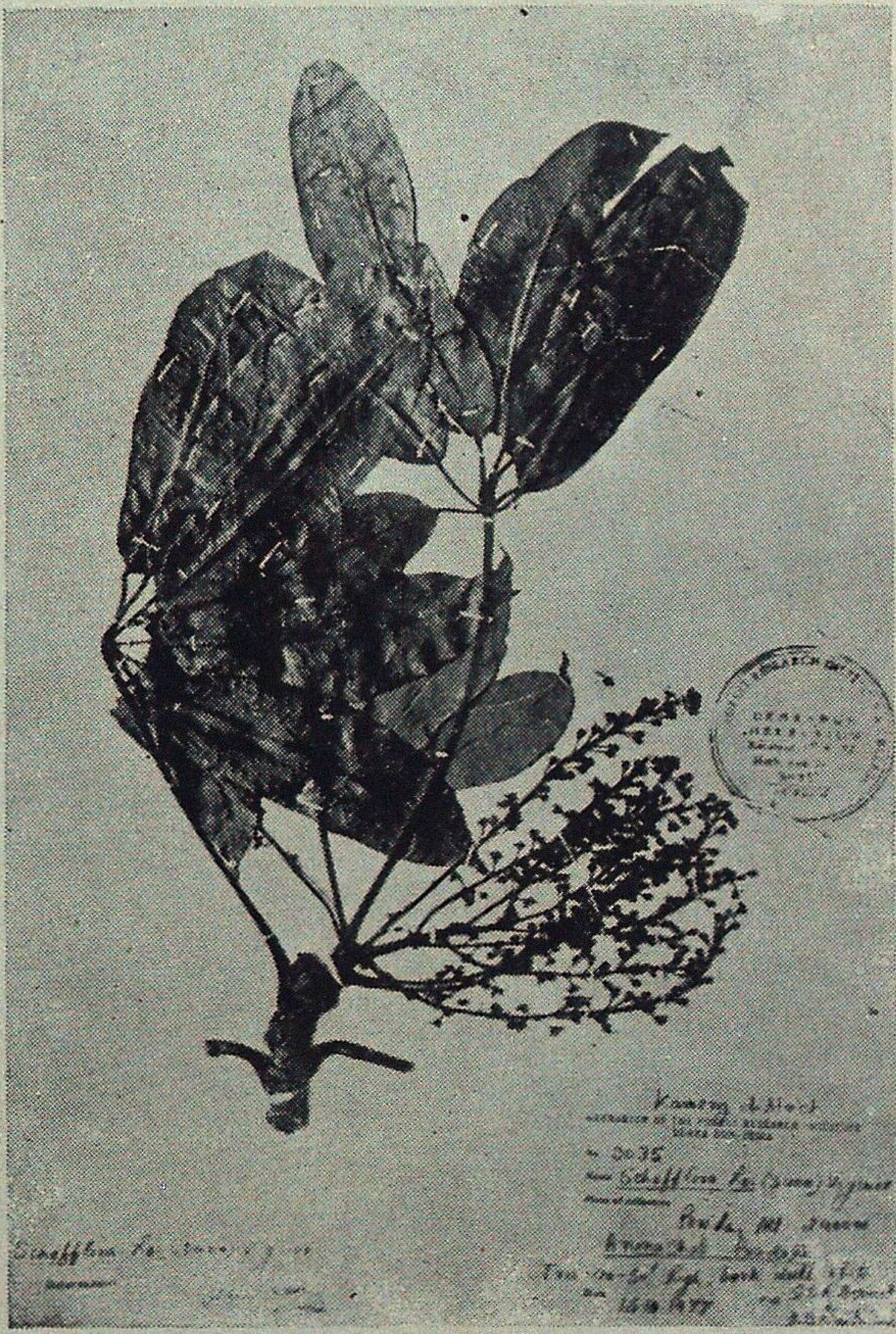
लेखक एच०बी० नैथानी व एस०एस०आर० बेनेट

सारांश

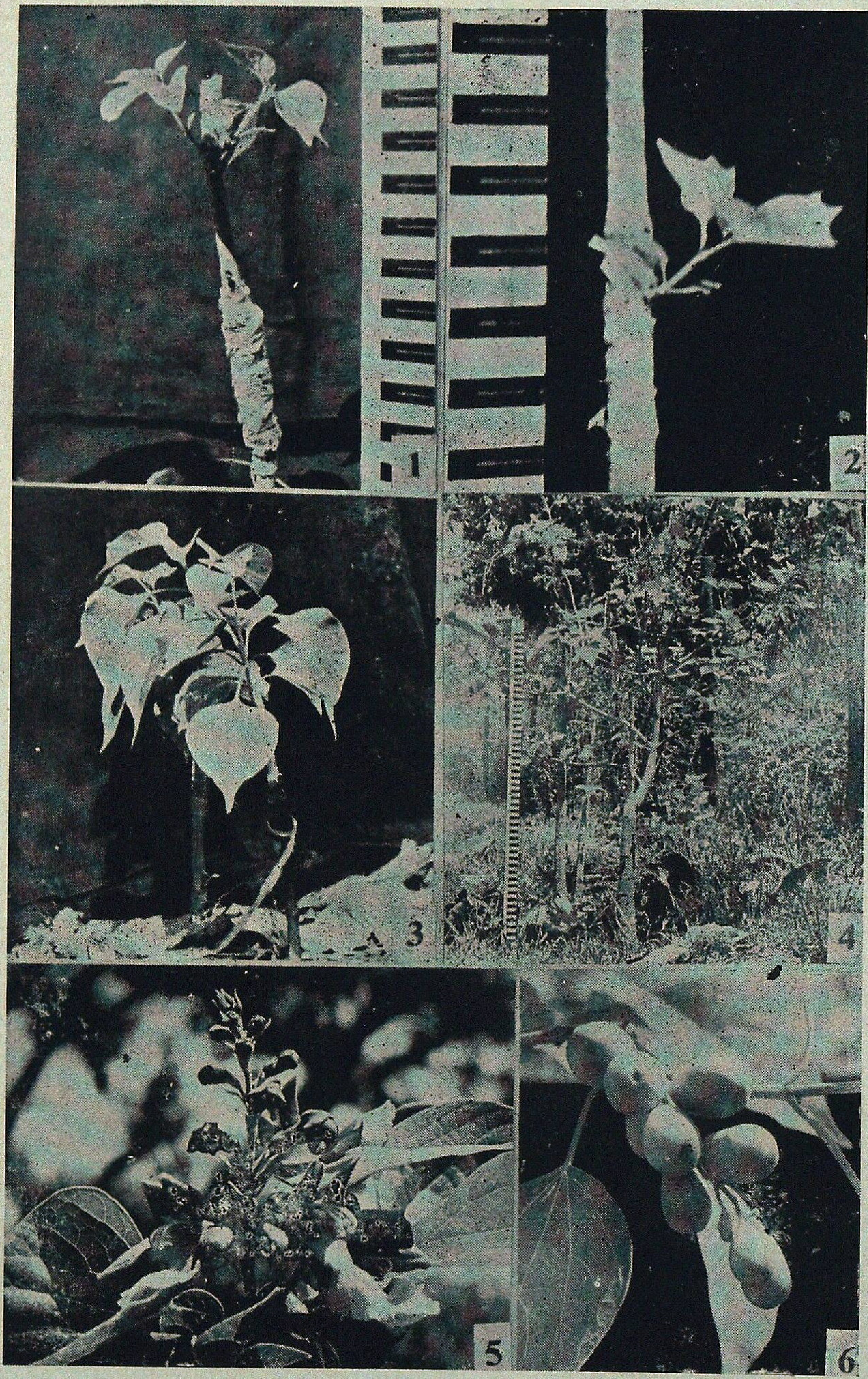
चीन का मूलवासी वृक्ष, शेफ्फ्लेरा होई (डन्न) विगुए प्रथम बार भारत में अरुणाचल प्रदेश से मिला, सूचित किया गया है।

———

A leaf



Shoot with inflorescence



Fig, 1—A sprouted cleft graft wrapped up with polythene tape.
Fig. 2—A sprouted bud graft wrapped up with polythene tape.
Fig. 3—A survived cleft graft.
Fig. 4—Flowering in bud graft (arrow indicates the point of union)
Fig. 5—A close up photo of flowers in bud graft.
Fig. 6—Fruiting in bud graft.

GRAFTING AND BUDDING IN YEMANE *GMELINA ARBOREA* ROXB.

R.S. ARYA AND M.S. HAQUE
Forest Genetices Branch,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Gmelina arborea, known in Hindi as Gumhar belongs to the teak family Verbenaceae. It is also commonly called as white Teak or Yemane. Because of its very rapid growth, ease of establishment and early returns the attention of the world's foresters was drawn towards this important tree species. In recent years large scale plantations have been raised on trial basis in many countries and many of the early results are promising too. Its detailed timber and pulp tests have revealed many valuable properties. From the point of economic returns in short term basis *Gmelina* has few rivals and for this its widespread planting has been recommended. In India it occurs naturally in Eastern region, mainly in Assam, North Bengal and adjoining areas. It also occurs sporadically in some parts of M.P., U.P. Maharashtra, Gujarat, Karnataka and Tamil Nadu. Because of its good prospects in large scale planting, it was thought essential to standardize the teehniques of vegetative propagation for future use in planting as well as for utlization of this technique in future genetic improvement programmes.

Vegetative propagation comprising of grafting, budding, cutting and air-layering is of greatest importance in forest tree breeding. It is a vital technique by which within a short time germplasm banks and clonal seed orchards can be established by assembling the desired clones of good genotypes. It also enables a tree breeder to multiply quickly for further planting of desired tree species and maintain the desired parental genotype. Another great advantage of vegetatively propagated trees in tree breeding is that these trees flower much earlier than the trees raised from seedlings and thus make it possible to raise future generations quickly. It also helps a tree breeder to do controlled pollination work on trees at approachable height. Also such trees can be planted in a convenient location instead of remaining scattered over a large area, thus facilitating in harvesting easily available seeds.

Very few works have been carried out on grafting and budding in *Gmelina arborea.* Moreover, all the available reports are from foreign countries (Lamb, 1968; Rahman, 1977; Zabala, 1977). In India, so far no attempt has been made on this species for such type of work. The present paper, the first of its kind in India, gives in detail the studies on grafting and budding in *Gmelina arborea* carried out at New Forest.

Materials and methods

For carrying out grafting and budding studies in *Gmelina arborea,* small plants of 2-years age were used as stock materials. The scions and buds were collected from 7-year old trees in Kaulagarh (New Forest) Forest Pathology Nursery. In all 10 grafts and 10 buds were made during the months of February, March and April, 1979.

Cleft grafting—The scions were collected from vigorously growing trees. The cuttings used were from branches of second year growth. The scions were so selected that their thickness matched well with that of stocks, so that cambium layers of both the materials come in close contact. 3 to 4 cm long wedge or tongue trimmed out of the distal end of the cutting was introduced in a cleft made on a stock cut end by splitting in two halves to the depth of 4 cm. This grafted portion was tied firmly with jute thread and than wrapped up with polythene tape, in order to conserve moisture inside and prevent desiccation in the grafted region (Fig. 1).

Patch budding—The technique was practised by removing a rectangular patch of bark from the internodal portion of the stock and replaced with the bark bearing a bud of the same size from the selected desirable tree. Polythene tape was wrapped around the patch portion leaving the eye free. The polythene tape was removed after two to three weeks when the wound portion was healed with sprouting of bud and there was an indication of good take.

Results

Survival—The grafted and budded plants were checked periodically to see the formation of callus and ultimate union of both the materials. All the grafts and buds made survived i.e. 100 per cent success was achieved (Figs. 2-3). The months of February and March were found to be the best period for maximum take.

Flowering—The grafted and budded plants were kept under regular supervision to see their growth performances. The plants became almost leafless in the month of February and it was also noticed that some panicles were appearing on the branches which continued upto the last week of April, 1980; i.e. just after one year of grafting and budding flowering started. The flowers were with irregular corolla about one inch long which were dull chestnut in colour with yellow tip and throat (Figs. 4-5).

Fruiting—The immature fruits were greenish and on ripening assumed yellowish colour. The fruits were collected from the budded plants in the month of June. These were succulent drupe ovoid to oblong (Fig. 6), in size varying from 1.7 cm to 2.5 cm with leathery shining yellow pericarp, a sweet pulp and a hard bony stone. The stones were 1.4 cm to 2.1 cm long, ovoid pointed at one end. There were usually 2-3 marks on the outer surface of the stone indicating the presence of 2-3 mature seeds inside it.

Germination—Fruits were sown in the soil in pots in the month of July. Germination started after about a month of sowing. 40 per cent of the fruits germinated.

Discussion

From the present studies it can be concluded that vegetative propagation of *G. arborea* by the techniques of grafting and budding is possible with no difficulty. Lamb (1968) also

mentioned that there was no difficulty in budding selected parents of yemane from the plantations on to seedling stocks. In our present study the success of 100 per cent was achieved both in grafting as well as in budding. The best period of such studies under Dehra Dun conditions was the months of February, March and April. It seems that this period would be suitable for establishing clonal seed orchards or for large scale vegetative propagation for many other purposes. However, Zabala (1977) found less than 50 per cent success in field grafting of yemane. Scions collected from the selected plus trees when grafted on root stock survived upto 48 per cent and 44 per cent for the months of August and December respectively. Again Rahman (1977) found good success in bud grafting of yemane in the months of April, and May while his cleft grafts were totally unsuccessful. In our studies both bud grafting and cleft grafting were equally successful.

Of the two methods of vegetative propagation standardized here, bud grafting is more preferable especially where a large number of grafts are to be made. It has got certain advantages over the cleft grafts, because the buds can be collected in large numbers from the branches of selected plus trees whereas for cleft grafts the number of scions from such trees should be limited, otherwise the plus tree may be weakened. As reported by Lamb (l.e.) flowering in Nigeria started just after 3rd year of planting, while under Dehra Dun conditions it generally starts after 5 years. On the other hand bud grafts made in March/April 1979 started flowering just after one year. These grafts are now regularly flowering in successive flowering seasons. So this method of vegetative propagation can also be utilized for inducing early flowering. In this connection it may be mentioned that the buds collected from very old trees did not flower earlier, only the buds collected from 7-year old trees flowered. It seems that for such studies young trees should be preferred. This observation is significant. These studies will be continued further. Along with these two methods of vegetation propagation, cutting and air-layering will also be tried in our Genetics Nursery for standardizing the techniques.

Acknowledgement

The authors are grateful to Shri R.N. Kaul, IFS, Director, Forestry Research, Forest Research Institute and Colleges, Dehra Dun for encouraging in writing this paper and to Dr. M.L. Kapoor, Officer-in-Charge, Forest Genetics Branch, Forest Research Institute, for suggesting modification, wherever necessary,

SUMMARY

In *Gmelina arborea* Roxb. (Yemane) techniques on cleft grafting and patch budding were developed successfuly at the Forest Genetics Nursery, New Forest, Dehra Dun. 100 per cent success was achieved using both the methods during the months of February, March and April. Bud grafts made in April 1979 flowered in the very next flowering season i.e. April, 1980. A few fruits were also collected from these plants which showed 40% germination. The grafts have also flowered for the successive seasons.

येमाने, मेलिना आर्बोरिया राक्सब० की कलम लगाना और कली बांधना

लेखक आर०एस० आर्य व एम०एस० हक

सारांश

मेलिना ग्रार्बोरिया (येमाने) में चीरी कलमें और टुकड़ा कली बांधने की प्रविधियां वन आनुवंशिकी रोपणी, न्यू फारेस्ट, देहरादून में विकसित करना सफल रहा है। फरवरी, मार्च और अप्रैल में लगाने पर दोनों विधियों में शत प्रति शत सफलता मिली। अप्रैल 1979 में लगाई गई कलिका कलमों पर अगली पुष्पन ऋतु अर्थात् अप्रैल 1980 में ही फूल आ गए। कुछ पौधों से फल भी एकत्र किए गए जिनसे 40 प्रतिशत अंकुरण हुआ। लगाई गई कलमों पर भी अगले मौसम में फूल आ गए।

References

Lamb, A.F.A. (1968). *Gmelina arborea,* fast growing timber trees of the lowland tropics, No. 1 Commonwealth Forestry Institute, Department of Forestry, University of Oxford.

***Rahman, A.H.M.M.** (1977). Vegetative propagation of few forest species. *Bano Bigygan Patrika* 6 (1) : 51-57.

***Zabala, N.D.** (1977). Field grafting of yemane, *Gmelina arborea* Roxb. and large leaf mahogany *Sweitenia macrophylla* King. *Pterocarpus* 3 (1) : 81-86.

———

*From Forestry Abstracts.

BUCHANANIA LANZAN, SPRENG.—STUDIES ON METHODS OF PROPAGATION AND ESTIMATION OF FRUIT YIELD

Y.C. RAI

Conservator of Forests, Utilization Circle, Lucknow, U.P. (India)

Introduction

Buchnania lanzan, Spreng. locally known as *chiraunji, piar, achaar,* or *chaar* is a valuable species, indigenous to and abundant in the mixed dry decidous forests of the Indian Peninsula. Till recently, it used to be treated as a *Kokat* or miscellaneous species, even in working plans, and as such did not have a separate enumeration statistic therein. Despite the present high market price reported to be Rs. 40.00–50.00 per kg, in major cities fetched by its kernal, which is used as a condiment, it is surprisingly considered merely as a supplement to the food of tribals and *"adviasis"* residing within forest areas. No systematic attempts appear to have been made for its detailed silvicultural studies, even in States abounding in the same, and perhaps no attempts have ever been made anywhere to regenerate it artificially on any sizeable scale.

The present paper deals with some recent studies of this species carried out by the undersigned when he was Silviculturist, Southern Region, U.P., Kanpur, with a view to the focus the attention of Foresters all over India, towards its importance and to spur them to conduct further researches, as also to consider the feasbility of afforestation of dry hill slopes at suitable sites with this species on a larger scale, in the interests of National economy.

Growing stock in Uttar Pradesh

Occurrence has been reported principally from two different types of forest zones of Uttar Pradesh. The first of these comprise of the dry outer Himalayan and Siwalik slopes contained in the *bhabar* and *terai* forests of Siwalik, East and West Dehradun, Lansdowne, Kalagarh, Ramnagar, Haldwani, North and South Pilibhit, North and South Kheri, East and West Baharaich, North and South Gonda and North and South Gorakhpur Forest Divisions, characterized under Champion and Seth's Forest Types-3C/C2a/C2d/ (ii), 5B/CI (a to c) & 5B/C2. It would be interesting to observe that here the occurrence of this species is very sporadic and fruiting, besides being irregular, does not appear to be very productive. Detailed studies on this subject are therefore needed, to determine the cause of this peculiar behaviour, specially in *Bhabar* areas.

The other tract, where its growth is sizeable and even gregarious in patches, corresponds to Southern/Northern dry decidous forest, belonging to Champion and Seth's Forest Types, 5A/C-3 to 5B/C-2. It has infiltrated into Types 5B/C1b to 5B/C1c, dry plains *sal*, transitional to dry Peninsular *Sal* and is also occassionally found over dry dicidous scrub, Types 5/DSI,

areas. Thus the Varanasi, Duddhi, Agori, North and East Mirzapur, Banda and to a limited extent, the Bundelkhand Forest Division, in the Southern Region of Uttar Pradesh, have pure pockets bearing *B. lanzan* trees. Here the fruiting is normal and is capable of being exploited on a commercial scale.

The summary of the Raw Material Resources of U.P. (Second Revision, 1978), containing the recorded population of *B. lanzan* trees in Uttar Pradesh in respect of this species is given in Table 1 to this article. From a perusal of the same, it will be noted that the enumeration data in respect of the Ramnagar, Haldwani, East and West Bahraich, North and East Mirzapur and Bundelkhand Forest Divisions are either missing or are incomplete, and it will now be possible to update these only after fresh surveys, either at the time of revision of the working plans of these divisions or through a seprate study of this species made by the Forest Resources Survey Divisions, U.P. This will be revealing and will indicate the rich population density of *B. lanzan* in Uttar Pradesh.

Yield

During 1979 summers, a few plus trees of *B. lanzan* were selected at the Dhurkari Nursery, North Mirzapur Forest Division and special watchers were kept to protect these from monkeys, birds and rodents. Fruit collections were made personally by the Research Ranger Kotwa from 23.5.79, when the ripe fruits began to fall naturally, and by 29.5.79 the entire crop of each such selected tree was get plucked and weighed after a fortnight. Similarly in 1980, the Reseasch Ranger made personal collection from these very tree plus six more trees from 18.5.80 to 3.6.80. The results are as under :

Tree No.	G.B.H. (cm)		D.B.H. class (cm)	Production of fruits in Kilograms	
	1979	1980		1979 (23.5.79—29.5.79)	1980 (18.5.80—3.6.80)
1.	85	85	20–30	5.50	3.50
2.	115	117	30–40	6.50	5.50
3.	116	116	30–40	4.00	5.00
4.	120	120	40–50	2.00	3.50
5.	120	120	40–50	5.00	4.50
6.	132	132	40–50	4.00	5.00
7.	145	148	40–50	6.50	7.50
8.	163	165	50–60	6.50	7.00
9.	80	80	20–30	——	4.00
10.	—	85	20–30	——	4.50
11.	—	85	20–30	——	5.00
12.	—	105	30–40	——	4.50
13.	—	117	30–40	——	2.00
14.	—	120	40–50	——	2.50
	Total production in	kgs :		40.00	64.00
	Average production/tree	:		5.00	4.57

It would be observed that the average fruit yield from these trees having a d.b.h. varying from 28 cm to 54 cm was about 5.00 kgm/tree. In other words, it indicated that the fruiting in the diameter class region of 30-60 cm is of the order of about 5.00 kg/per tree. It will further be observed that the total period of seedfall was just seven days in 1979 and seventeen days in 1980. 1979 was a very dry year and 1980 an inordinately wet year. Both 1979 & 1980 appeared to be normal seed years, and this experiment will be repeated in 1981 as well.

The random samplings of these fruits, 100 No. each, were further weighed and the results are as under :

Sample No.	Weight in grams
1.	20.02
2.	29.18
3.	26.64
4.	25.55
5.	28.02
6.	28.29
7.	25.62
8.	27.70
9.	27.46
10.	26.09
	Total : 264.57

Average weight/100 fruits = 26.46 gms.
Average weight per fruit = 0.265 gms.

The average of these weighings therefore gave their number at 378 fruits/100 gms or between 3,500-4,000 fruits/kgms (dry). An average size fruit weighed about 0.60 gms in the green. Again, after the fruits were fully air dried and broken, 250 gms of the same yielded 65 gms of kernel (1,034 nos.) and 185 gms of husk. In other words, one kilogram air dried fruit was found to yield between 200 to 300 gms of edible seeds. Thus, a tree of diameter class varying between 30-60 cm, can be said to yield between 1.0 to 1.50 kg of edible seeds per tree.

On this basis, the total annual production of edible seeds from these classes of trees from the reserved forests of U.P. alone, be quite considerable, specially as the present wholesale rates at main markets of U.P. is nearly Rs. 40.00 per kg. The potential value of this minor forest produce will therefore be obvious.

Size of Seeds

In general, three distinct sizes of seeds were discerned and average statistics in respect of these was found to be as under :

	Big	Average	Small
Weight	0.11 gms	0.08 gms	0.03 gms
Length	0.74 cms	0.58 cms	0.51 cms
Breadth	0.56 cms	0.41 cms	0.38 cms
Thickness	0.37 cms	0.32 cms	0.31 cms

Characteristics of *B. lanzan* bearing soils of Mirzapur, Ageri and Dudhi Forest Divisions

Thirteen samples of soils at zero level were got analyzed for determining as many as fourteen important soil characteristics at three different places and the result of this analysis is as per Table 2.

From a perusal of the data given in the above, it transpires that these soils bearing *B. lanzan* in the Mirzapur district are nearly neutral, have a low electrical conductivity showing low salt concentration, medium to high organic Carbon, Potassium, Phosphorus, Nitrogen and Iron, indicating a corresponding high degree of fertility. However, these have a medium to very low moisture retention capacity.

The above indicate only a microscopic section of the different zones over which *B. lanzan* occurs naturally and far more work is needed to type the same. These however, do provide a glipse of the characteristics of soils needed for its large scale propagation under proper climatic conditions given by Troup and others.

Artifical regeneration

Experimental trials done hither-to have given low germination per cent. One of the chief reasons for this appeared to be the sowing of relatively unripe seeds used tn nurseries. Direct departmental collections are seldom made, and the field staff often obtain seeds from the local villagers, Now, with the numerous enemies of ripe fruits like birds, rodents and monkeys, the villagers usually pluck ripening, but not fully ripe fruits, which are thereafter dried. Sowing of such fruits cannot give satisfactory results, for obvious reasons.

In the experiments conducted by the undersigned, several mother trees were kept fully protected all the twenty-four hours by a team of watchers right from the time the ripe fruits started falling naturally, which was about the last week of May. Thereafter, these were all got collected under close departmental supervision and sent to nurseries, where these were dried under shade, for about a fortnight.

It was observed that sowings of such fruits at Kotwa, Mirzapur from 16.5.79 to 30.6 80 gave about 85% germination, but that it progressively fell with the passage of time. The results obtained from delayed sowing trials at our Kanpur Nursery were as under :

B. lanzan

Results of sowings of 1979 collections at Kanpur Nursary

Date of sowing of seed	Date when germination started	Date when germination finally stopped	No. of days taken for		% Germination
			Start of germination	Completion of germination	
15.6.79	28.6.79	15.7.79	13	30	15
30.6.79	15.7.79	28.7.79	15	28	29
16.7.79	28.7.79	9.8.79	12	24	32
31.7.79	7.8.79	20.8.79	7	20	21
15.8.79	29.8.79	15.9.79	14	31	14
1.9.79	No germination due to heavy rainfalls.				
17.9.79	30.9.79	16.10.79	13	29	35
3.10.79	22.10.79	5.11.79	19	33	15
16.10.79	5.11.79	20.11.79	20	32	15
31.10.79	24.11.79	2.12.79	24	32	5
	No trials between 1.11.79 and 14.3.80				
15.3.80	1.4.80	13.4.80	16	29	9
30.3.80	13.4.80	28.4.80	14	29	10
15.4.80	29.4.80	14.5.80	14	29	7
30.4.80	14.5.80	29.5.80	14	29	14
15.5.80	No germination	—	—	—	—

The above reveals that germination normally starts after 10-15 days and gets completed in about four weeks or so. Sowings of August and September at Kotwa gave a very low germination percentage although there was no corresponding fall at Kanpur due perhaps to a better climate.

The seedlings are delicate and considerable mortality was observed in transplantings from seedlings beds. It may therefore, be better to sow the seeds directly in big size polythene bags and keep these in nurseries for a period of two years, prior to their transfer to field sites. Rainfall caused heavy mortalities in the nurseries and considerable damping off was noticed.

Experiments conducted in the Forest laboratory at Kanpur for testing the effect of sowings at different depths as also scarifications from the above lot of seeds, gave the following percentage results.

Treatment	Duration of scarification in hours/mts.	Germination percentages Depth of sowings in cm				
		1 cm	2 cm	3 cm	4 cm	5 cm
Control		45	30	30	20	—
Soaking in water at room temperature	12 hrs	25	36	15	15	—
	24 hrs	30	30	15	5	10
	72 hrs	35	20	15	—	—
Soaking in hot water	5 minutes	15	30	15	10	10
	10 minutes	30	20	10	5	—
	15 minutes	25	20	15	10	5
Soaking dill. H_2So_4	5 minutes	45	25	—	—	—
	10 minutes	20	10	20	20	10
	15 minutes	40	5	15	20	5

The above figures indicate that the *B. lanzan* seed does not require any pre-treatment and that it does best when kept under 1.00 cm. deep soil. In fact it is expected that sowings at 0.5 cm level soil depth will give an even better result. This point requires to be got tested again

Vegetative propagation

Experimental trials revealed that propagation through cuttings and rootsuckers have failed but that *B. lanzan* is a very good coppicer. Plants accidentally got cut at collar level, threw fresh shoots within a short time.

Gum from *B. lanzan*

A small quality of gum exuded by *B. lanzan* trees of Dudhi Division was sent to the Harcourt Butler Institute of Technology, Kanpur. The results of its analysis is given below :

1.	Total ash	9.497%
2.	Ash insoluble in dil. HCl.	6.346%
3.	Viscosity at	18.5°
	0 1 % solution :	1.086 Centipoises
	1 0 % solution :	1.464 Centipoises
4.	pH. : 0.1 % solution	6
	1.0 % solution	8
5.	Solubility	Swells in cold water and dissolves on dilution
6.	Adhesive power	yes
7.	Fat	5.15 %
8.	Total sugar	10.5 %
9.	Protein	3.9 %
10.	Calorific value	1.033 cal./gram.

Table 1

Growing stock (in number of trees)

Name of species : *Buchanania lanzan (Chiraunji)*

Sl. No.	Division	Diameter class in cm								
		10-20	20-30	30-40	40-50	50-60	60-70	70-80	80 & over	Total
1	2	3	4	5	6	7	8	9	10	11
1.	Siwalik	1,51,355	84,453	16,933	2,411	296	99	—	—	2,55,546
2.	West Dehradun	25,585	8,925	1,310	107	14	—	—	—	35,941
3.	East Dehradun	11,582	16,336	5,403	807	76	28	—	—	34,232
4.	Lansdowne	83,668	75,227	16,825	1,865	310	114	47	32	1,78,088
5.	Kalagarh	2,27,172	1,39,421	29,297	3,100	409	52	22	6	3,99,461
6.	Pilibhit	29,352	11,212	1,853	303	65	9	7	9	42,810
7.	North Kheri	3,417	11,370	6,798	769	124	92	5	1	22,576
8.	South Kheri	8,188	29,471	9,892	1,841	173	19	4	—	49,588
9.	North Gonda	562	64	42,415	5,638	625	95	41	—	49,440
10.	South Gonda	896	3,015	395	52	7	4	—	—	4,369
11.	Gorakhpur	299	390	137	21	18	1	—	—	866
12.	Varanasi	35,193	22,177	8,575	3,171	1,381	446	62	—	70,945
13.	Duddhi	14,60,999	2,48,717	15,871	1,571	149	49	32	27	17,27,515
14.	Agori-Bijaigarh	5,33,410	69,405	8,342	1,338	160	43	20	8	6,12,726
15.	North Mirzapur	3,390	2,856	1,224	270	36	24	—	—	7,800
16.	Banda	2,26,977	96,743	21,857	12,755	3,342	2,697	—	—	3,64,371
	Total :	28,02,045	8,19,722	1,87,209	36,019	7,184	3,772	240	83	38,56,274
	Percentage	72.662%	21.257%	4.855%	0.934%	0.186%	0.098%	0.006%	0.002%	100%

Table

Analytical chart showing properties of

Sl. No.	Lab. sampe No.	Block and compart-ment	Location	ph	E.C. mm/cm	Org. Carbon %	Org matter	Total N. %
1	2	3	4	5	6	7	8	9
1.	519	—	Dhurkari Nursery	7.20	0.097	0.60	1.04	0.052
2.	520	—	,,	7.21	0.117	1.58	2.73	0.135
3.	521	—	,,	7.21	0.079	1.43	2.47	0.123
4.	522	—	,,	7.34	0.080	0.72	1.25	0.062
5.	523	—	,,	7.42	0.091	1.47	2.54	0.127
6.	536	Khatabaran ct. 7	—	6.37	0.067	2.34	4.04	0.202
7.	537	—do—	Silva Expt. No. 51	7.05	0.051	0.88	1.43	0.071
8.	538	—do—	Tendu plot (1975)	6.75	0.084	0.96	1.66	0.083
9.	539	Garia, Ct.4	In front of Danti Block	6.69	0.067	0.96	1.66	0.082
10.	540	—	Silva, Expt. No. 39	6.55	0.075	1.65	2.85	0.142
11.	541	Garia, Ct.5	—	6.46	0.067	0.89	1.54	0.072
12.	542	—	—	6.46	0.153	1.38	2.38	0.119
13.	543	—	Silva, Expt. No. 49	6.93	0.081	0.87	1.50	0.075

2

Chiraunji bearing soils of Mirzapur District

Tolat K. %	Total P_2O_5%	Ava. K. %	Avail. P. %	Moist' %	Ignit %	HCl in solu. %	P_2O_3 %	Fe_2O_3 %
10	11	12	13	14	15	16	17	18
0.255	0.0165	0.0155	0.001	0.429	4.612	84.129	10.72	1.44
0.250	0 0216	0.0145	0.0020	0.927	6.217	87.804	4 33	1.12
0 320	0.0256	0.0205	0.00175	0.512	4.912	90.008	3.92	1.112
0.355	0.0348	0.255	0.0015	0.325	5.119	82.001	11.02	2.16
0 270	0.02562	0.0180	0.00175	0.516	5.437	83.107	10.64	1.92
0.255	0.0175	0.0245	0.0014	1.821	9.212	80.754	8.02	1.76
0.270	0.0263	0.0120	0.00030	1.723	5.012	87.075	6 15	1.12
0.295	0.0092	0.0155	0.00030	2.651	4.001	83.982	9.52	2.48
0.0925	0.0192	0.0242	0.00040	0.821	5.17	84.127	10.17	2.88
0.430	0.0346	0.0380	0 00165	0.725	6.02	83.987	9.24	2.88
0.380	0.0193	0.0190	0.0010	0.902	6.12	83.752	9.10	2.16
0.330	0.0226	0.0610	0.0013	0.715	4.07	90.110	5.76	2.00
0.390	0.0257	0.0125	0.0010	1.009	6.75	83.004	9.11	1.84

The Institute however could not comment on its possible use on human consumption owing to lack of further testing facilities.

Composition of *Chiraunji* seeds

Analytical report of *Chiraunji* seed have given the following results.

Oil	:	51.8 %
Starch	:	12.0 %
Protein	:	21.6 %
Sugar	:	5.0 %

Chiraunji oil can be used as a substitute for olive and almond oils.

Insect damage

Buchnania lanzan is a delicate species. Even partial debarking on trees marked as standards, to be protected from fellings in any coupe, often resulted in the rotting of the exposed portion, that was attacked by stem borers. In the Garia block of the Muirpur range of the Duddhi Forest Division, a number of *B. lanzan* trees, mostly in 30–60 cm dia. classes were found to be so attacked. The borers had permeated right upto the centre of the stem, which had been hollowed out. Presumably as a reaction to this damage, the entire hollowed zone was found full of copious *Chiraunji* gum, that had also killed a number of the larvae of these insects. A few live larvae were collected and sent to the Entomology department of the Kanpur Agricultural University, where these were reared and subsequently identified as *Batocera rufomaculata*.

SUMMARY

***B. lanzan (chiraunji, piar, achaar, chaar)* is an important species of Peninsular India, yielding valuable edible seeds used in condiments, but surprisingly, it has continued to be neglected in the matter of scientific studies. This paper gives certain new information on its population in U.P., its seed production capacity, seed size, characteristics of *Chiraunji* bearing soils, proper sowing period, mode of sowing, composition of its seeds, and certain properties of its gum, along with the identification of an insect damaging its stems, with a view to interest foresters all over the country to conduct further research work on this economically valuable species with a view to expand the area under its cultivation.**

बुकनेनिया लैंजन स्प्रेंग०—प्रवर्धन रीतियों और फल प्राप्ति का अनुमान लगाने विषयक अध्ययन

सारांश

लेखक वाई०सी० राय

बु० लैंजन (चिरौंजी, पिआर, अचार, चार) प्रायद्वीपीय भारत की महत्वपूर्ण पादप जाति है जिससे मूल्यवान खाद्य बीज प्राप्त हो जाते हैं जिन्हें व्यंजनों में उपयोग किया जाता है, परन्तु अचरज की बात है कि वैज्ञानिक अध्ययनों में इसकी निरन्तर उपेक्षा होती रही है। इस अभिपत्र में उत्तर प्रदेश में इसके वृक्षों की संख्या, इसकी बीज उत्पादन क्षमता, बोने का उचित समय, बोने की रीति, बीजों का गठन, इसके

गोंद की कुछ विशेषताओं के बारे में कुछ नई जानकारी दी गई है तथा इसके तने को हानि पहुंचाने वाले एक कीड़े की पहचान कराई गई है जिससे देश भर के वानिकों की इसमें रुचि हो जाए और वे आर्थिक महत्व वाली इस पादप जाति का कृषि क्षेत्र बढ़ाने के लिए और अधिक अनुसंधान कराएं।

References

Communication (1980). Director, H.B.T.I., Kanpur to the Silviculturist, Southern Region, U.P., Kanpur.

CSIR (1950). *Wealth of India* Vol. II (Raw Materials).

Kotwal, P.C. (1978). Some oil yielding plants of Madhya Pradesh, *Vaniki Sandesh*, Vol. II.

Rao, V.S. (1953). Vegatative propagation and forest tree improvement *Ind. For.*, **79** (3) : 176–193.

Troup R.S. (1921). *Silviculture of Indian Trees*, Vol. I.

UTILISATION OF WOOD, CANE AND BAMBOO FOR HANDICRAFTS

J.C. JAIN AND M.C. TEWARI

Forest Research Laboratory, Bangalore (Karnataka)

Introduction

Handicrafts, irrespective of the nature of raw material used, are a valuable cultural heritage of any community and are an expression of the peoples' culture, environment, tradition, folklore etc. Handicrafts may be broadly divided into two categories (i) those for utilitarian purposes e.g. tools, household ware, weapons etc. and (ii) those which are purely for decorative and expressive purposes.

Wood has been traditionally used as a raw material for both the categories of handicrafts. Different kinds of timbers are used for elaborate carving with extra-ordinary precision. Several articles, mainly of fancy and decorative nature are made by hand on cottage industry basis : e.g. sandalwood and rosewood carvings of Karnataka and Kerala; wooden toys of Varanasi (U P.), Baroda and Junagarh (Gujarat); human and animal figures including figures of Gods and Goddesses of Kondapalli (Andhra Pradesh) and Trichur (Kerala); nirmal industry of Hyderabad (Andhra Pradesh); walnut carving of Kashmir; ivory inlay work of Hoshiarpur (Punjab); shishamwood carving of Saharanpur (U.P.), etc.

Apart from wood, other natural products like bamboos, canes, grasses, reeds etc. are also used all over the country for making articles of utility and artistic nature such as baskets, boxes, trays, toys and dolls, wall hangings, furniture, flower vases, lamp stands, brooms, chicks, mats, curios, walking sticks, umbrella handles, craddles, fishing rods, musical instruments (flutes, horns, clarionets, drums, etc.), bows and arrows, hookah pipes, thatch roof and the like. There is an ever increasing demand of such articles.

It is gratifying to note that mainly through the efforts of All India Handicrafts Board these industries have received great impetus in both domestic and export market.

Defects

Wood has been traditionally used for handicraft articles because it is light in weight, easy to work with, possesses adequate strength, is warm to touch and easy to finish. Being a natural product it has its own specific colour, beautiful grains and can be polished or painted at desired. Added to these inherent qualities, it requires little energy for conversion. However, it has certain drawbacks. There are very few species of timbers like teak, rosewood, sandalwood etc. which possess naturally durable heartwood (which is resistant to the attack of wood destroying agencies) while majority of the species which are used for handicrafts, for example, haldu/yellow teak *(Adina cordifolia)*, halewood *(Wrightia tinctoria)*, mango *(Mangifera indica)*, etc. need protection against the attack of fungus, borers and termites. As such

sapwood of durable species and both sap and heartwood of non-durable species need protection against the wood destroying agencies during storage and also while in use. Names of various timbers which are recommended for making specialised items of handicraft are mentioned in literature (Trotter, 1944). Indian Standard Specification IS : 399-1963 also enlists some common species of timbers recommended for furniture, turnery articles and toys and their availability. All timber species whether belonging to naturally durable class or not need seasoning before use to prevent egrades like end splitting, surface cracks, warping, etc.

Bamboo and cane too suffer from similar defects. Being of biological origin these materials are also susceptible to the attack of wood destroying agencies. Moulds and fungi also attack them. Numerous complaints are received regarding insect and fungal attack on finished articles and also on raw material during storage Instances have also come to notice about deformation in shape due to twisting, warping or shrinkage of the finished article. As such the need for preventing seasoning degrades and biological attack on handicraft articles needs no emphasis.

Seasoning

Seasoning (i.e. drying of timber) can be carried out by several methods such as air seasoning, kiln seasoning, solvent seasoning, high frequency drying, etc., but only the first two kinds of methods are of commercial importance in this country. Ordinarily seasoning is applicable to sawn sizes or to semi-finished articles or half wroughts. Usually combination of air seasoning and kiln seasoning is desirable.

(a) *Air seasoning.* Air seasoning is the simplest and cheapest method of drying wood in which the wood has to be carefully protected from the vagaries of weather such as hot winds, rain, blazing sun, etc. In this connection different kinds of sheds have been designed to be used depending upon the refractoriness of different species of timbers as per details given in Indian Standard Specification IS : 1141-1973.

(b) *Kiln seasoning.* Kiln seasoning is the most efficient and quick method of drying wood. In this case the moisture is slowly drawn out from the innermost part of the wood by controlling temperature and humidity inside the kiln/chamber which may be suitable for the purpose, Schedules of drying vary with the species and cross-section involved. Indian Standard specification IS : 1141-1973 covers classification of timbers for seasoning purposes, preliminary treatment, storage, seasoning methods including requirement of seasoning kilns, kiln operation and kiln schedules for different species of timbers and inspection, storage and transport and seasoned timber. The ultimate moisture content to which timber has to be dried is also very important to avoid its movement (i.e. changes in dimension) with variation in the climatic condition. The quantum of dimensional change also varies with the type of article. Therefore, maximum permissible moisture content of timber used for different purposes in different climatic zones is specified in IS : 287-1960.

Seasoning kilns vary widely in construction, mode of heating and humidification, air circulation system and way of operation. Heating in kilns is carried out by flue gases from a

furnace fired by wood waste or oil. Steam heating is extensively used. Electrically operated kilns have not become popular so far due to the shortage and high cost of power.

Few kilns using solar heat have also been installed. Installation (W.S. Br., F.R.I.) of a solar kiln of 7.1 m^3 (250 cft.) capacity is estimated to cost Rs. 20000/– approximately. Several types ofsteam and furnace heated seasoning kilns suitable for use in India have been designed by the Forest Research Institute, Dehra Dun (U.P.).

Generally (Tewari, 1978) 2.5 cm thick planks of highly refractory woods take about 6 months and 5 cm thick planks about a year for air seasoning in places like Dehra Dun (U.P.), Planks of moderately refractory hardwoods of thickness 2.5 cm take about 4 months while bigger sections upto 7.5 × 10 cm take 6 months to one year for air seasoning. It has been observed (Tewari, 1978) that drying in solar kiln reduces air drying period by about 60% for planks and 35–55% for framing timber. Thus the operating (W.S. Br., F.R.I.) cost is found to be only 1/3rd to 2/5th of that for kiln drying of timber in a small steam heated kiln of indentical output.

Seasoning of bamboo can be carried out in split or round form. Split bamboo in the form of strips does not offer any major problem in seasoning. Sometimes discoloration and borer attack may take place. These defects can be prevented by the application of suitable prophylactic compositions during air drying as recommended in IS : 401-1967.

Bamboo seasoning in round form either in air or kiln has been difficult because of its anatomical structure. It is liable to split at ends and crack at nodes. Sharma *et. al.* (1792) have found out a one-step process for successful seasoning and preservation of *Dendrocalamus giganteus* in round form to prevent cracking, splitting, fungal attack, discoloration or insect attack during seasoning and in subsequent service using 50% water solution of PEG-600 in admixture with boric acid and sodium pentachlorophenate (1 : 1). Details of antishrink treatment are given in IS : 1141-1973.

Preservation

As stated earlier timber, bamboo and canes need adequate preservative treatment to protect them against the attack of wood destroying agencies. A number of preservatives along with the absorptions to be given are recommended for various outdoor and indoor uses in the IS : 401-1967 for wood and in IS : 1902-1961 for bamboos and cane used for non-structural purposes. It is learnt that Central Handicrafts Development Centre, Bangalore (Anon) has also developed methods of not only preserving bamboos but also for bleaching and dyeing them.

One of the main problems of the industry is the non-availability of well seasoned raw material due to which retention of shape and size has been adversely affected in exported articles which are used in developed countries in air-conditioned houses. The problem of seasoning of wood by individual firms becomes particularly difficult due to small requirements of individual units with limited capital. It is gratifying to note that Industries Departments of various States are helping installation of seasoning kilns for common service.

In developed countries like U.S.A. (Fiest) outdoor woodworks treated with water repellent like wax in admixture with a small quantity of pentachlorophenol has already given a service life of 20 years without any decay. Unfortunately similar compositions are yet to be developed in our country.

It would be seen that there would be enormous loss of material, money and labour if simple techniques of seasoning and preservation of timber, bamboo and cane are not adopted. Where kiln drying facilities are not available, air drying can be reported to. The cost of preservative treatment in case of handicraft articles would never be high as very low absorption of different preservatives are required which can be obtained by simple techniques like brushing, dipping, etc. Any small amount of money spent in this regard is duly compensated b preventing seasoning degrades and biological attack to the handicraft articles.

Guide lines for rational utilisation of timber, bamboo and canes in handicrafts :

1. Only sound material free from natural defects should be selected.

2. The material should be stored under hygienic conditions before conversion to smaller sizes.

3. During storage of the raw material proper prophylactic measures should be adopted as recommended in IS : 401-1967. End coating for preventing splitting of the wood should be given as per IS : 1141-1973.

4. Stacking during storage and seasoning of the material should be carried out as recommended in IS : 1141-1973.

5. Where facilities for kiln seasoning are available and the material is to be finally impregnated with water soluble wood preservatives (e.g. furniture [items of non-durable species) the preservative treatment should be carried out after air seasoning the timber. After prservative treatment kiln seasoning can be carried out.

6. All wood working etc. should be finished before application of wood preservatives.

References

Anon—*Bamboo Craft* (C.H.D.C.), Banglore.

Communication – Wood Seasoning Branch, Forest Research Institute, Dehra Dun (U.P.).

Fiest, C.W.—"Protecting Woodwork without Preservatives". *Research and Application, For. Prod. Lab.*, U.S.D.A Wisconsin, U.S.A.

Sharma, S.N., M.C. Tewari and R.P. Sharma (1972). "Chemical seasoning of Bamboos in the round for handicraft" *Jour. Timb. Dev. Assn.* 18 (1) : 17.

Tewari, M.C. (1978). "Servey of conditioning treatment practices in India". Paper presented at the 10th Annual meeting of the International Research Group on Wood Preservation.

Trotter, H. (1944). "Common commercial timbers of India and their uses". *Manager of Publications*, Delhi.

—————

INDIGOFERA TORULOSA W. KHAN—A NEW SPECIES FROM THE DECCAN PLATEAU

M A. WADOOD KHAN

Teacher Research Fellow,
Department of Botany, Marathwada University, Aurangabad (Maharashtra)

Indigofera torulosa Wadood Khan sp. nov. (Fig. 1)

Indigofera trita L f. similis, tamen differt *foliis* subcoriaceis, dense incanis atque tomentosis, *racemis* 10-20 floratis, *leguminibus* torulosis atque 2-5-seminalis, *seminibus* luteis angulosis atque fusiformis.

BEED, Sautada, *Wadood Khan* 539 a (Holotypus) et 539 b-d (Isotypi) positi in Herbario, Marathwada University, Aurangabad.

Suffruticose under shrub about 1 m tall covered all over with appressed hoary tomentum. *Leaves* 3-foliate, leaflets elliptic, 1-2 5 – 0.7-1 cm, obtuse, mucronate; stipules minute, linear-lanceolate, 1-3 mm long *Racemes* axillary, slender 2-4 cm long, 10-20 flowered; pedicels 5-7 mm long. *Flowers* pink or Pale rose coloured; calyx 2 mm long, lodes subulate; corolla 5-7 mm long. *Pods* 1.5 to 3.2 cm long, angular, torulose to moniliform, appressed hoary tomentose, divaricate, straight or slightly curved, shortly beaked, often 2-5 seeded, rarely one seeded. *Seeds* Yellow, spindle shaped, angular.

Occasional on open gravelly slopes of hills, gregarious, Fls. & Frts. September to December.

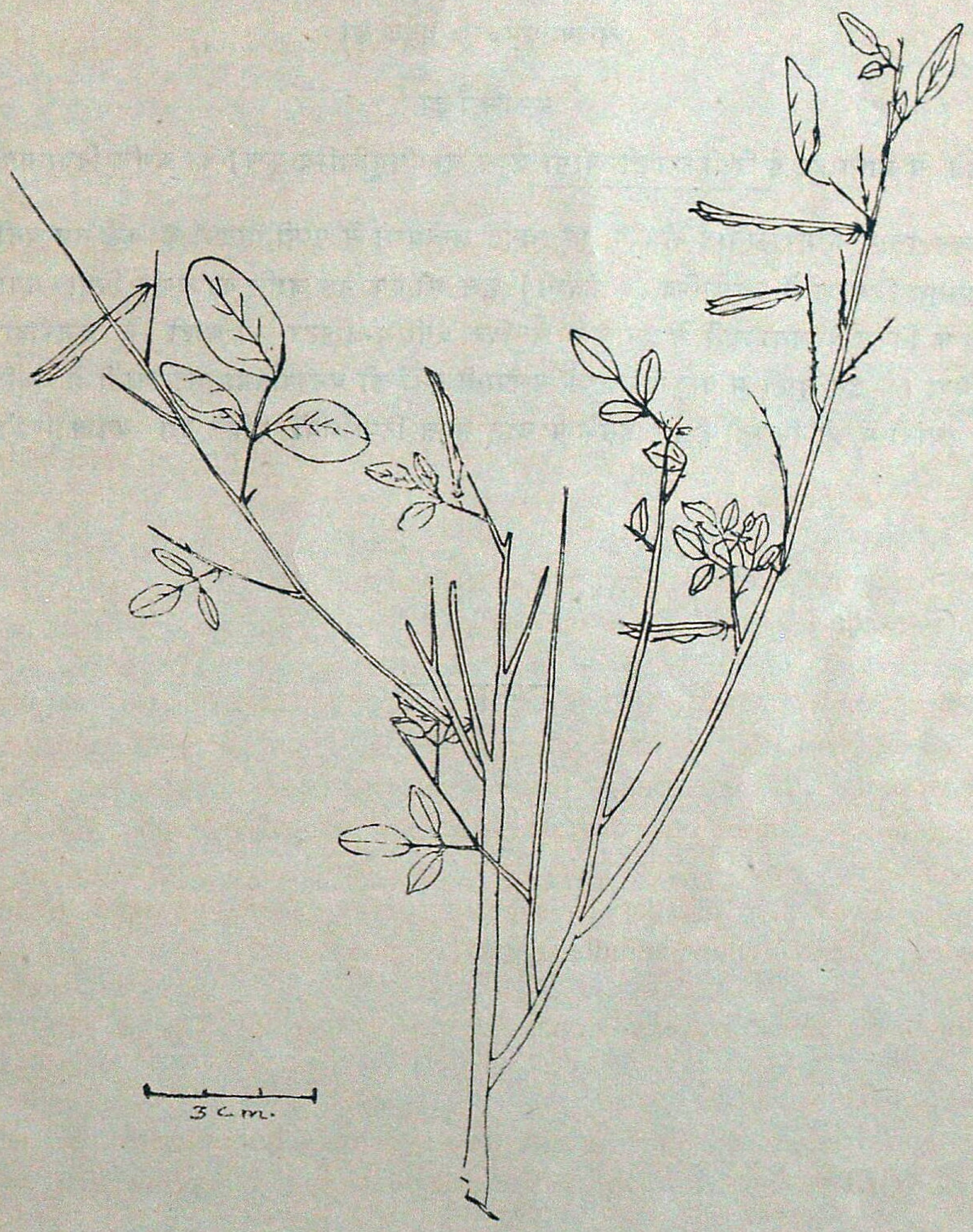
Similar to *I. trita* L.f. but differs in having densely hoary tomentose, sub-coriaceous leaves; 10-20 flowered racemes; torulose, 2-5 seeded pods and yellow, angular, spindle shaped seeds.

BEED, Sautada, *Wadood Khan* 539 a (Holotype) and 539 b to d (isotypes) are deposited in the Herbarium of Marathwada University. Aurangabad.

Acknowledgements

I wish to acknowledge my grateful thanks to Dr. K.M. Matthew, S.J. Director, the Rapinat Herbarium St. Joseph's College, Tiruchirapalli for Latin diagnosis and to my guide Dr. V.N. Naik, Department of Botany, Marathwada University, Aurangabad for valuable suggestions.

Fig 1.



SUMMARY

Indigofera torulosa **Wadood Khan (Fabaceae) is described from Beed district.**

Recent exploration of Marathwada region on the Deccan plateau of this country has yielded a few interesting taxa of the flowering plants. The present report describes one such species of the Fabaceae, collected from the gravelly edges of the U-shaped valley formed around a fall of the Penganga river near Sautada in the district of Beed. The valley harbours a typical dry deciduous forest vegetation while the new taxon occupies open situations on slopes. Following is the description of the taxon together with relevant notes.

दक्न के पठार से एक नई पादप जाति–इंडिगोफेरा टोरुलोसा व० खां

लेखक एम०ए० वदूद खां

सारांश

बीड़ जिले से प्राप्त हुई इंडिगोफेरा टोरुलोसा वदूद खां (पृथुशिम्बि कुल) का वर्णन दिया गया है।

देश में दक्न पठार के मराठावाड क्षेत्र में हुए विगत अन्वेषणों से पुष्पी पादपों के कई नए वर्गीकारिकी एकक प्राप्त हुए हैं। प्रस्तुत विवरण में पृथुशिम्बि (=फैबेसी) कुल की एक नई जाति का वर्णन दिया गया है जिसे बीड़ जिले में सौतडा के निकट पेनगंगा नदी के प्रपात के चतुर्दिक बनी यू-आकार की घाटी के बजरीदार किनारों से इकट्ठा किया गया। इस घाटी में प्रारूपिक शुष्क पर्णपाती वनों की वनस्पतियां पाई जाती हैं जबकि यह नई जाति ढलानों के खुले स्थानों में ही मिलती है। इसके पश्चात् संगत टिप्पणियों सहित इस वर्गीकारिकी एकक का वर्णन दिया गया है।

INFLUENCE OF GRAZING ON THE ROOT DEVELOPMENT OF HERBAGE SPECIES IN A TROPICAL GRASSLAND AT KANPUR, INDIA

L C. MISHRA

Department of Botany, D.A.V. College, Kanpur, India

Introduction

The root system of a plant represents almost one half of the total material produced by that plant and must be taken into account when the effect of environmental factors on plant development are studied.

Comprehensive data are available on the root growth responses to stresses and perturbations (Crider 1955, Ramam 1970, Singh and Ambasht 1975, Shrimal and Vyas 1975). Shankarnarayan reviewed the literature on impact of grazing on the grasslands and reported many studies on the effects of defoliation on root development. The present study deals with the effect of grazing on the root development of common species occurring in the grasslands at Kanpur. The species studied included three grasses viz., *Cenchrus ciliaris, Dichanthium annulatum* and *Hetropogon contortus* and three forbs viz., *Desmodium triflorum, Evolvulus nummularis* and *Indigofera linnaei*.

Study site

The study site is a part of the dairy farm of C.S. Azad University of Agriculture and Technology Kanpur located at 26° 26′ N latitude, 80° 22′ E longitude and 124 m above the mean sea level. An enclosure (10 m × 10 m) protecting the then existing vegetation was established there past ten years back, within this enclosure a good stand of grass has come up. The area outside the enclosure (5 ha) had been grazed by cows and goats with an average 5 head for the whole plot. The soil is pale brown sandy loam with pH of 7.5.

Materials and methods

In order to study the impact of grazing on the root system of plants five randomly located monoliths (25 × 25 × 40 cm) were dug out both within and outside the enclosure every month between July to November 1975. These monoliths were soaked in water for 24 hours, and then washed with a fine jet of water using a 32-mesh screen. The root systems were floated in water contained in the rectangular tank with least disturbance to natural orientation of roots. Quantitative data for rooting depth and amount of branching along the first 20 cm of main root was recorded for each species. Root diameter was measured on 10 main roots of each plant, cut from the base of the plant with the help of a caliper. Root system of 5 individual plants of each species was dried at 80°C and weighed.

Result and discussion

The rooting depth, amount of branching and root biomass were the parameters of root development most consistently affected by grazing (Table 1). Statistical analysis of the mean, and a simple t-test, showed significant differences in all cases at 0.05 level. Root diameter was highly variable and no significant differences were observed between protected and grazed plants.

Table 1

Effects of grazing on root development (± SD)

Species	Rooting depth (cm)	Branch (Ist 20 cm)	Root diameter (cm)	Root biamass (g/plant)
Cenchrus ciliaris				
Protected	34.6±4.0	76±13	0.83	1.5
Grazed	26.1±3.1	43± 8	0.81	0.8
Desmodium triflorum				
Protected	26.4±2.5	14± 3	2.0	1.3
Grazed	19.0±1.8	8± 2	2.1	0 7
Dichanthium annulatum				
Protected	32 0±3.6	70± 9	0.61	1.2
Grazed	25.3±2.7	40± 5	0.59	0.7
Evolvulus nummularis				
Protected	27.2±2.8	38± 5	1.7	0.5
Grazed	20.5±1.9	16± 2	1.7	0.3
Heteropogon contortus				
Protected	28.2±3.2	86±15	0.8	2.0
Grazed	20.4±2.1	64±10	0.8	1.1
Indigofera linnaei				
Protected	30.7±3.2	32± 6	2.5	1.5
Grazed	22.0±2.4	16± 4	2.3	0 8

The fact that defoliation results in a reduction in the total root mass of the plant so treated has by now been documented in several studies and with various species (Nelivigi 1962, Sant 1961). The results of the present study reveal that much of this reduction comes from a tendency towards reduction in length and less branching of the roots.

Acknowledgements

The author is grateful to Prof. R. Misra for his valuable guidance and encouragement during this study. Thanks are also due to the U.G.C. for the award of a Teacher Research Fellowship under the scheme of Faculty Improvement.

References

Crider, G J. (1955). Root growth stopage resulting from grass defoliation, *U.S.D.A. Tech. Bull* 1102. 23 p.

Nelivigi, V.G. (1962). Ecology of grazing effects and reproductive capacity of six forbs in grass vegetation of Varanasi. *Ph.D. Thesis, Banaras Hindu University.*

Ramam, S.S. (1970). Root development in alluvial grasslands of Varanasi, *Indian For.* 96 : 100-110.

Sant, H.R. (1961). A study of the reproductive capacity of some grasses and forbs of the grounds of the Banaras Hindu University. *Ph.D. Thesis, Banaras Hindu University.*

Shankarnarayan. K.A. (1977) Impact of overgrazing on the grasslands. *Annals of Arid Zone* 16 : 349-359.

Singh, U.N. and R.S. Ambasht (1975). Biotic stress and variability in structure and organic (net primary) production of grassland communities of Varanasi, *India. Trop. Ecol.* 16 : 86-95.

Shrimal, R.L. and L.N. Vyas (1975). Net primary production in grasslands at Udaipur, India. pp 265-271. In : F.B. Golley and E. Medina. *Trop. Ecol. Syst.* Springer-Verlage. New York.

HYDERABAD PLYWOOD INDUSTRIES LIMITED

NACHARAM INDUSTRIAL AREA,

HYDERABAD–501 507

*

Manufacturers of

FLUSH DOORS, DECORATIVE PLYWOOD AND BLOCK BOARDS

with latest techniques and Modern Imported Machinery

FIRST AND ONLY FACTORY OF ITS KIND
IN ANDHRA PRADESH

Phones: 71129
71964

Grams: "Decoply"

A STUDY ON THE STRENGTH OF 5 MM DIA COMMON WIRE NAILS UNDER VARIED CONDITIONS OF MEMBERS THICKNESSES (DOUBLE SHEAR AND QUADRUPLE SHEAR) IN STRUCTURAL JOINT OF *PTEROCARPUS DALBERGIOIDES*

K.S. PRUTHI AND A.N. BAJAJ

Timber Engineering Branch,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Technique of nail jointed timber construction has made an indelible mark on the economy of building construction during recent years. Some fundamental aspects regarding lateral strength of diamond pointed plain shanked wire nails when used as connectors in timber construction have been established. Considerable experimentation has been carried out on laying down principles of design, behaviour of nailed joints, prototype testing of nailed components and lateral strength data of 3.55 mm dia nails and most recently that of 5 mm dia nails. For large span structures 5 mm dia 150 mm long nails are most commonly employed in modern timber design and construction (mono-chord and split-chord type) and thus there is a definite need to study different facets of nail-joints made with such nails.

Scope of the Tests

In view of the requirements of design of timber structures, the tests were carried out for four different conditions of thickness of members forming the nail-joints under two types of loadings using *Pterocarpus dalbergioides* (Padauk) timber belonging to "Standard" group.

Test Series A—This series of tests was made on three member joints with nails in double shear and member thickness as under :

Central member (1) = 175
Outer side members (2) = 37 5 mm, each.

Test Series B—Double shear joints with member thickness as under :

Central member (1) = 60 mm.
Outer side members (2) = 45 mm, each.

Test Series C—Double shear joints with member thicknesses as under :

Central member (1) = 50 mm.
Outer side members (2) = 50 mm, each

Test Series D—This series of tests was made on five member joints with nails in quadruple shear and each member thickness as 30 mm.

Exprimental Procedure—General

The method of preparing and testing the joints was identical in all the series. Plain shanked, diamond pointed nails were used for making the joints. Due consideration was given to maching the timber in each joint and within each replication to minimize variability by basing the experimental design on randomized blocks. For each treatment, a minimum of five joint replications were considered adequate consistent with the material available. In each joint, eight nails each of 5 mm dia and 150 mm length, were driven in four rows, two nails in a row and adjacent nails driven alternatively from each side of joint as per standard practice.

The timber was planed on all sides and test specimens were assembled in a clamping jig to ensure alignment of members. Nails were driven normal to the wood surface and in prebored holes (bit size 4.48 mm) at a minimum nail spacing as given below, to prevent splitting of timber.

End distance	=	10 d
Edge distance	=	5 d
Intermediate distance	=	5 d
Row spacing	=	5 d

Where 'd' is the shank diameter of nail used.

Construction of Joints (Member Sizes)

Depending upon the number of nails used and their placement according to standard spacing in two rows, the sizes of members forming the joints are worked out and joints made. (Plate I, A & B).

1. *Joints loaded parallel to grain*

In such joints, the members are placed in such a position that these are loaded parallel to their grain.

2. *Joints loaded perpendicular to grain*

(a) Double shear joints : Three members in a joint are placed in such a position that the central member is loaded parallel to grain of wood and outer two members are members loaded perpendicular to their grain.

(b) Quadruple shear joints : Five members in a joint are placed in such a position that the central two members are loaded parallel to grain and the outer three loaded perpendicular to their grain.

Table I gives at a glance the formation details of joints in different series of tests reported herein.

Table 1

Formation details of nail joints using 8 nails of 5 mm dia in different series of tests

Test Series	Number of members	Member thickness (mm)		Joints loaded parallel to grain		Joints loaded perpendicular to grain			
						Central members		Side members	
		Central	Side	Member length (mm)	Member width (mm)	Length (mm)	Width (mm)	Length (mm)	width (mm)
A	3	75	37.5	175	125	355	125	500	100
B	3	60	45	,,	,,	,,	,,	,,	,,
C	3	50	50	,,	,,	,,	,,	,,	,,
D	5	30 mm each.		,,	,,	250	125	500	100

Method of testing and recording of data

Joints were loaded to failure in a compression testing machine. Speed of testing, measured from the loading platens of the testing, machine, was 0.065″/min (0.165 cm/min). Loading interval was as selected and maintained that the rate of stressing the nails was fairly constant and deflection readings could be easily recorded.

The joints were so placed that the centre of cross-section of the specimen was vertically in line with the centre of the moving heads of the machine. The rate of loading was maintained constant throughout the test.

Method of measuring joint slip, which is the displacement of inner member (s) relative to the outer members, is illustrated in Plate II. Slip readings were recorded by means of a dial-gauge (least count 0.01 mm) at regular increments of load throughout the test. Test results were statistically analysed to obtain valid conclusions from the observed data.

All types of failures in the joints test-specimen and any other special point of observation were recorded.

Test Results and their Interpretation

Load-slip plots were prepared for test-results of different test-series and the following data was determined (Plate III, A & B) :

(i) Limit of proportionality.
(ii) Load at allowable slip of 1.5 mm for temporary construction.
(iii) Load at restricted slip of 0.4 mm for permanent construction.
(iv) Load at a max slip of 10 mm, termed as yield load.
(v) Maximum Breaking load.

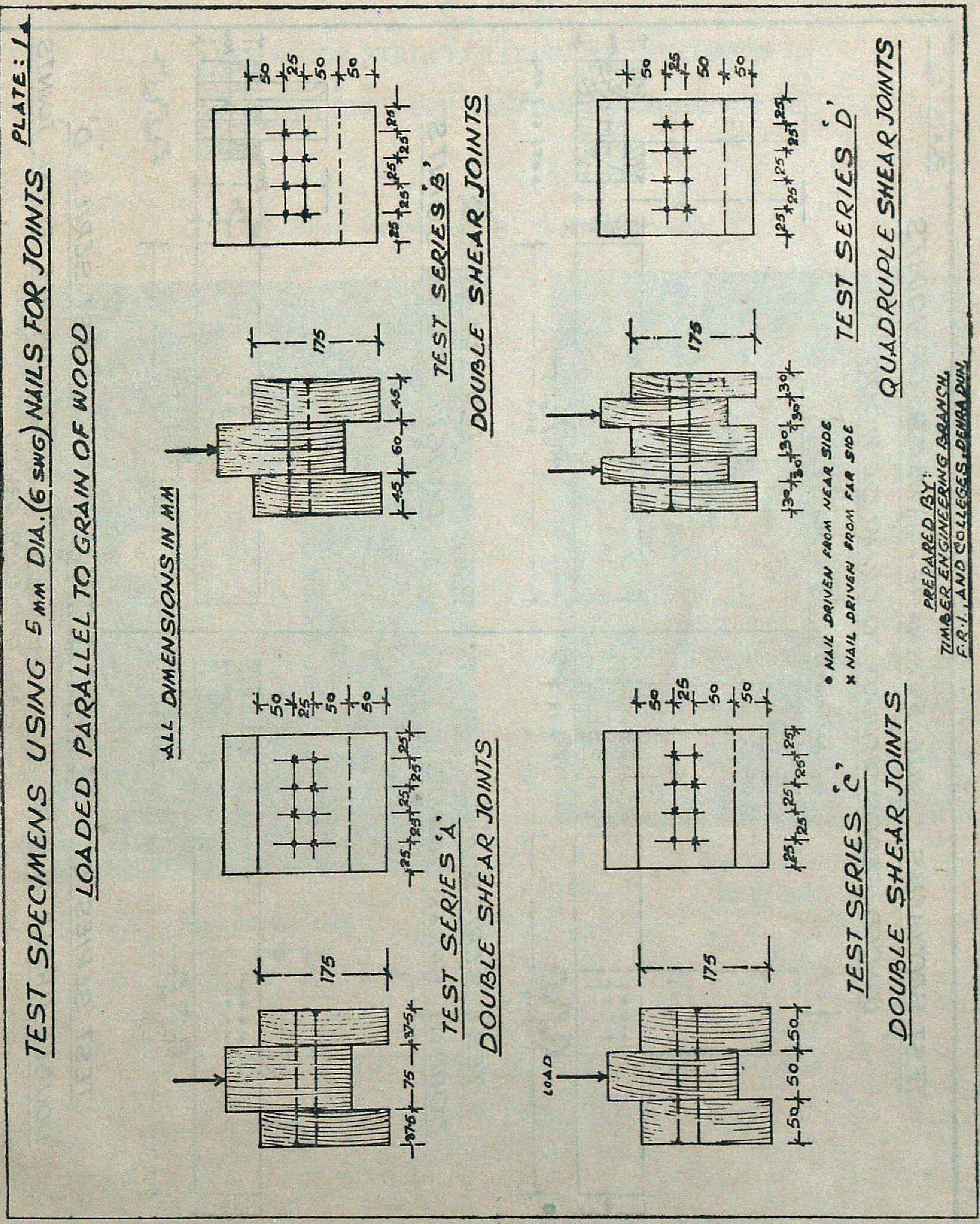


PLATE : 1
TEST SPECIMENS USING 5 MM DIA. (6 SWG) NAILS FOR JOINTS
LOADED PARALLEL TO GRAIN OF WOOD
ALL DIMENSIONS IN MM
LOAD
175
TEST SERIES 'A'
DOUBLE SHEAR JOINTS
TEST SERIES 'B'
DOUBLE SHEAR JOINTS
TEST SERIES 'C'
DOUBLE SHEAR JOINTS
TEST SERIES 'D'
QUADRUPLE SHEAR JOINTS
• NAIL DRIVEN FROM NEAR SIDE
x NAIL DRIVEN FROM FAR SIDE
PREPARED BY:
TIMBER ENGINEERING BRANCH,
F.R.I. AND COLLEGES, DEHRA DUN

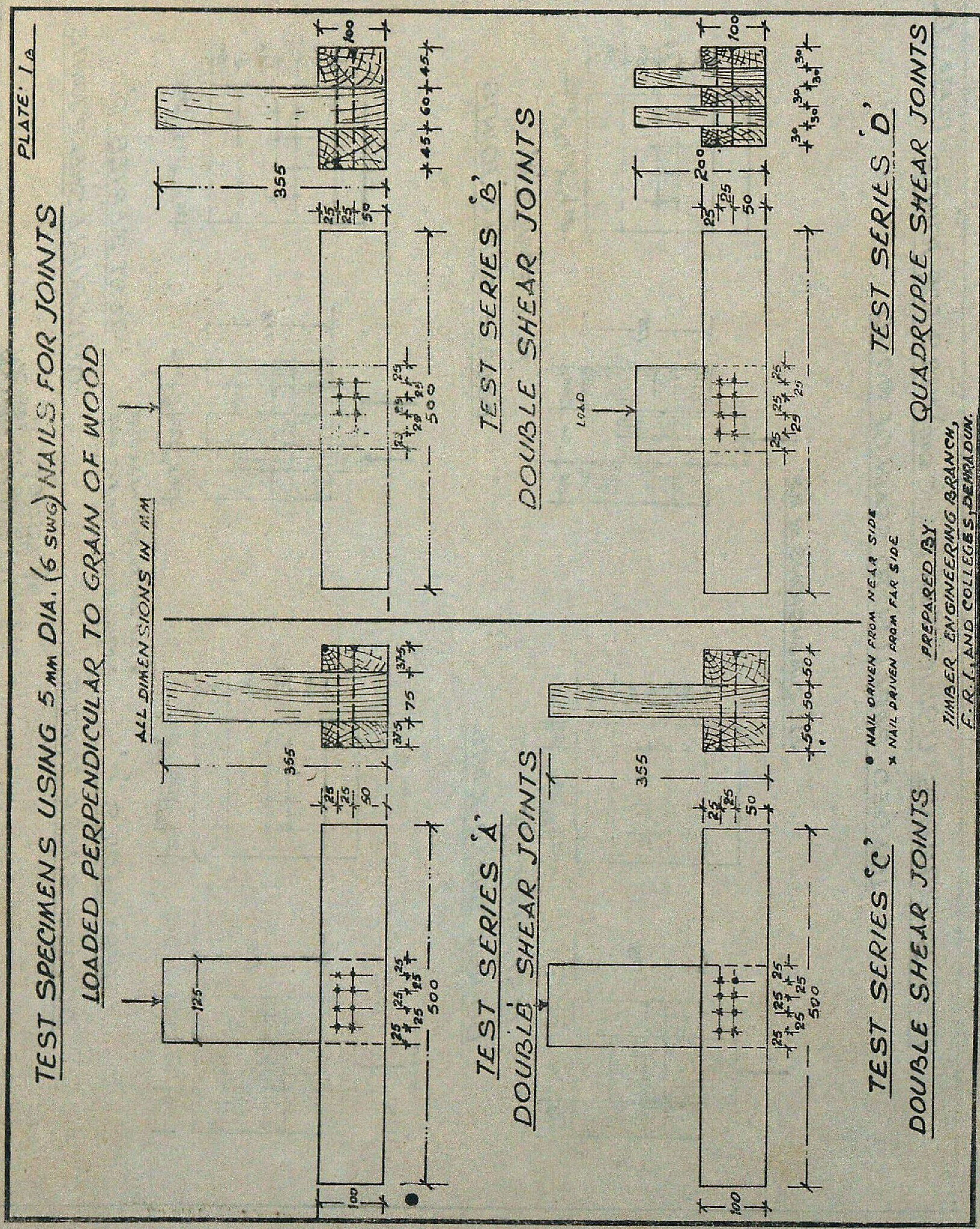
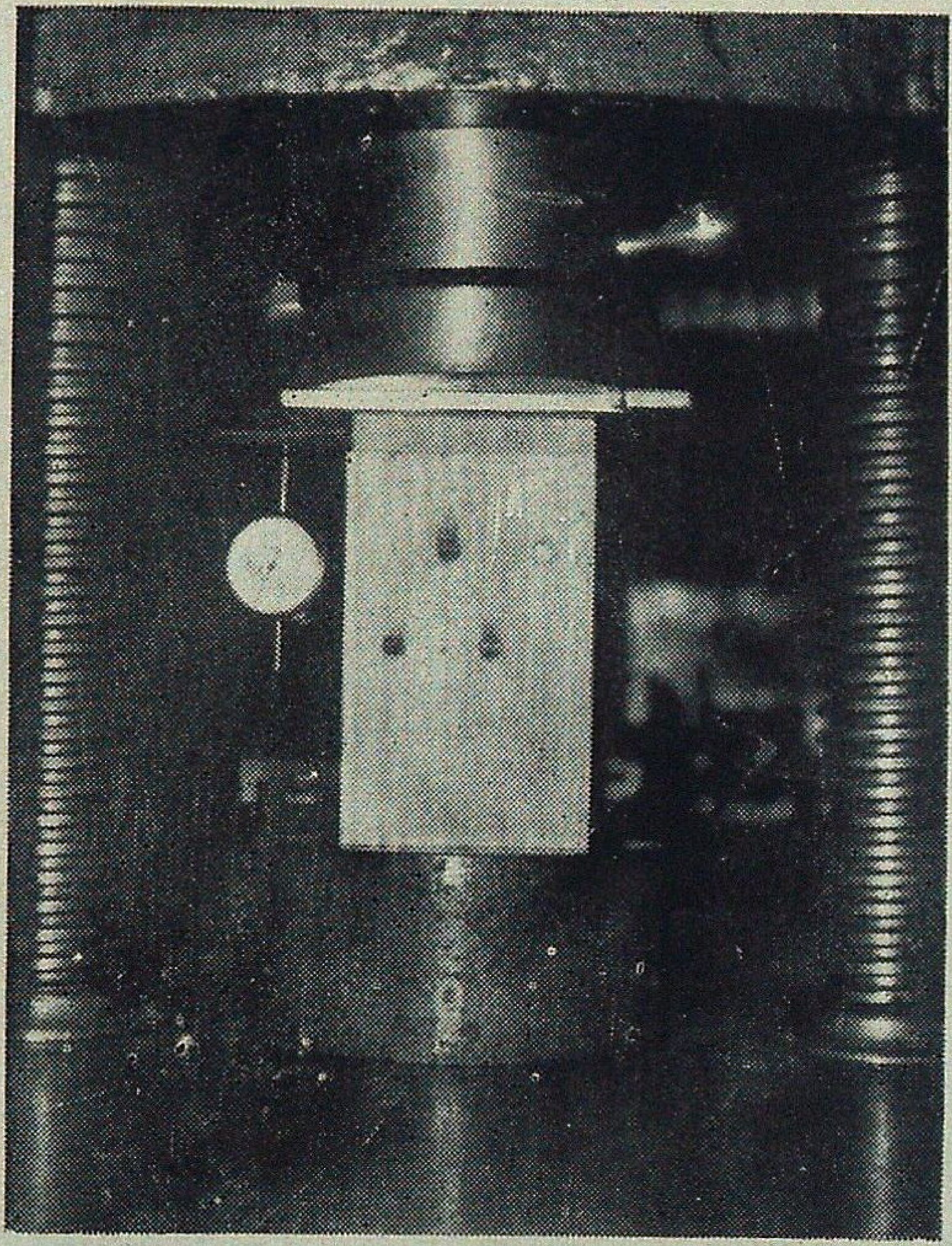


PLATE: Ia
TEST SPECIMENS USING 5 MM DIA. (6 SWG) NAILS FOR JOINTS
LOADED PERPENDICULAR TO GRAIN OF WOOD
ALL DIMENSIONS IN MM
TEST SERIES 'A'
DOUBLE SHEAR JOINTS
TEST SERIES 'B'
DOUBLE SHEAR JOINTS
TEST SERIES 'C'
DOUBLE SHEAR JOINTS
TEST SERIES 'D'
QUADRUPLE SHEAR JOINTS
LOAD
● NAIL DRIVEN FROM NEAR SIDE
× NAIL DRIVEN FROM FAR SIDE
PREPARED BY:
TIMBER ENGINEERING BRANCH,
F.R.I. AND COLLEGES, DEHRADUN.

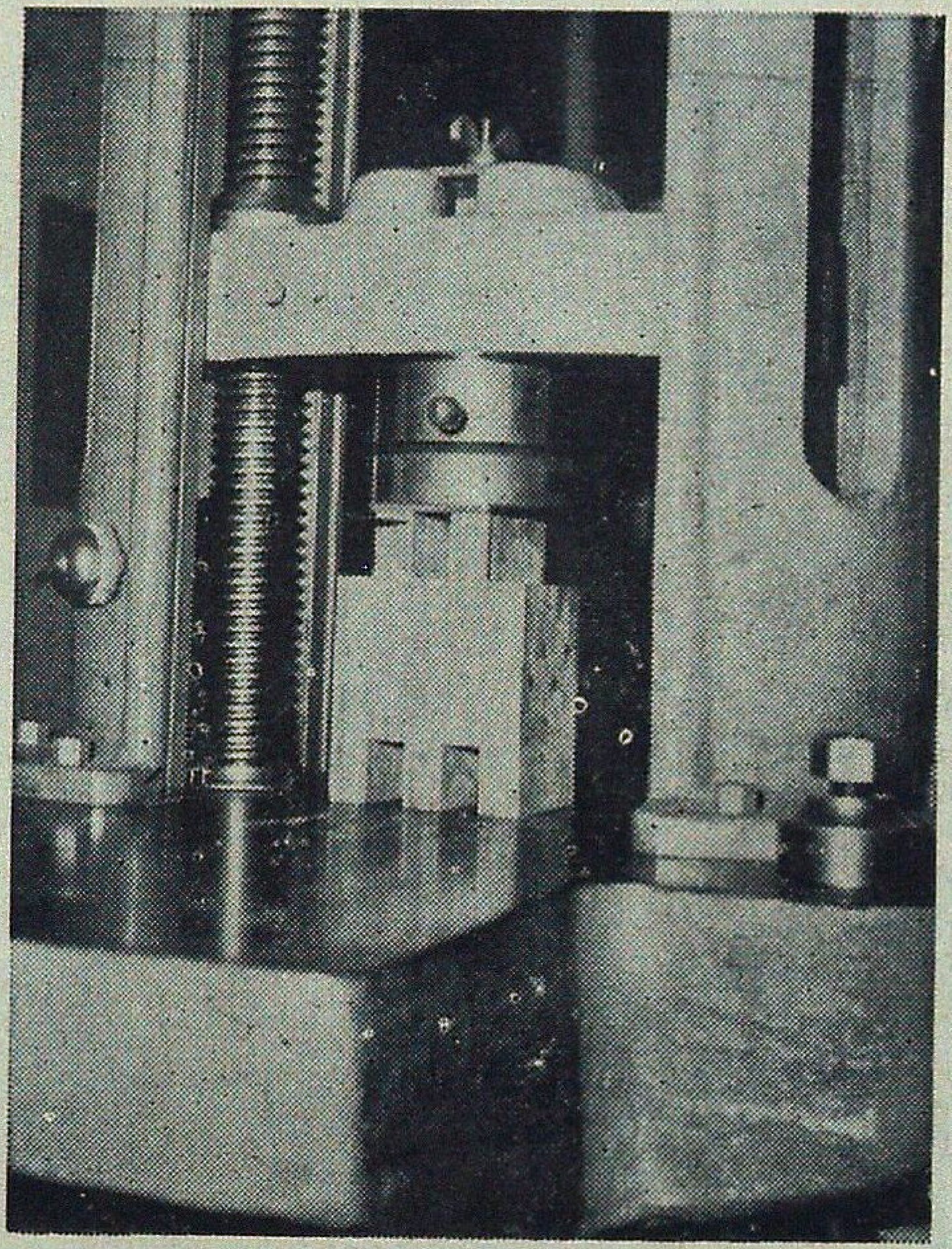
PLATE II

TESTING OF STRUCTURAL JOINT SPECIMENS IN COMPRESSION TESTING MACHINE

Joints loaded parallel to grain of wood



A typical double shear joint under test



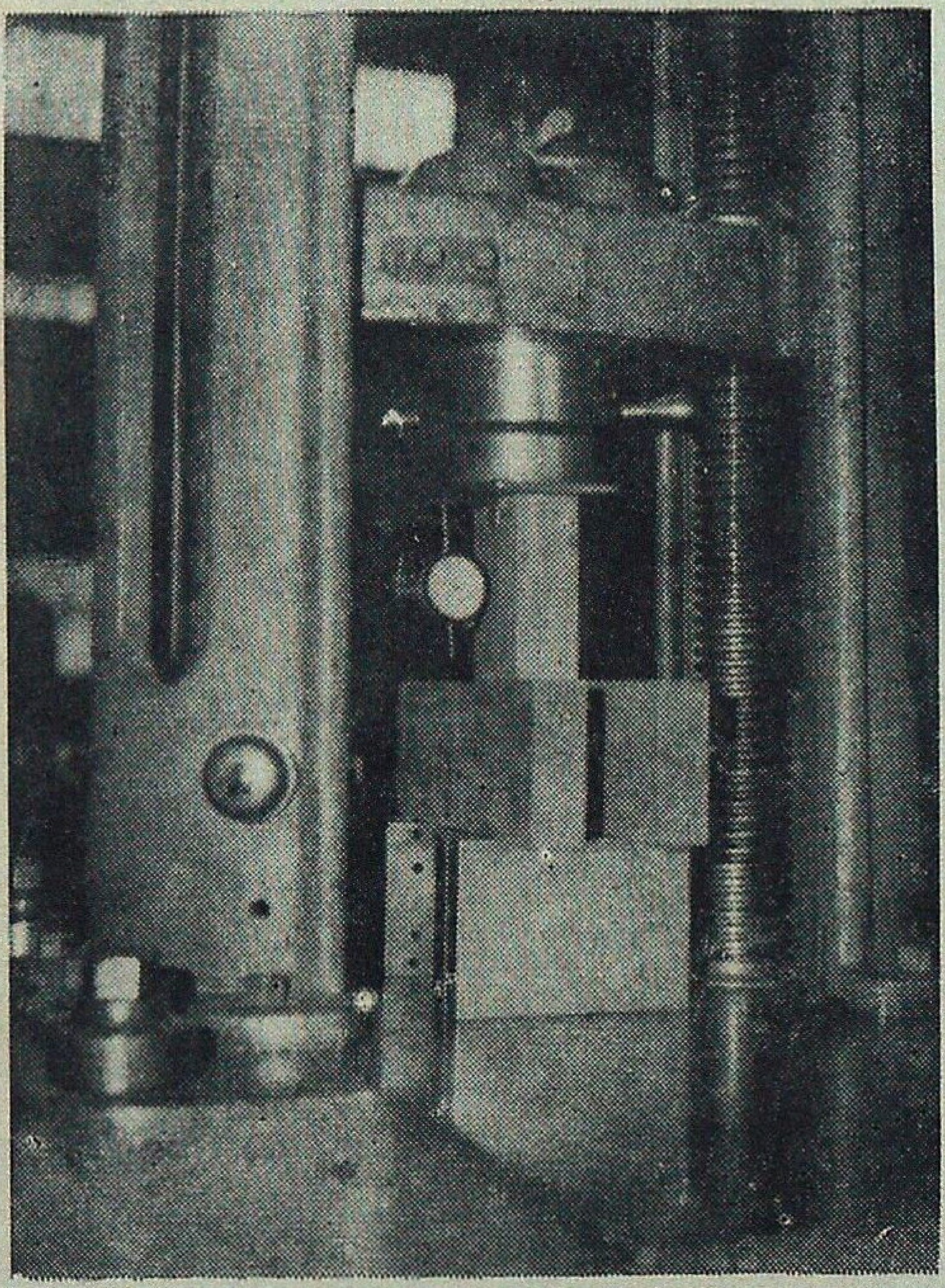
A typical quadruple shear joint

DIAL GAUGE HELPS RECORD DEFLECTION READINGS UNDER INCREASING LOADS

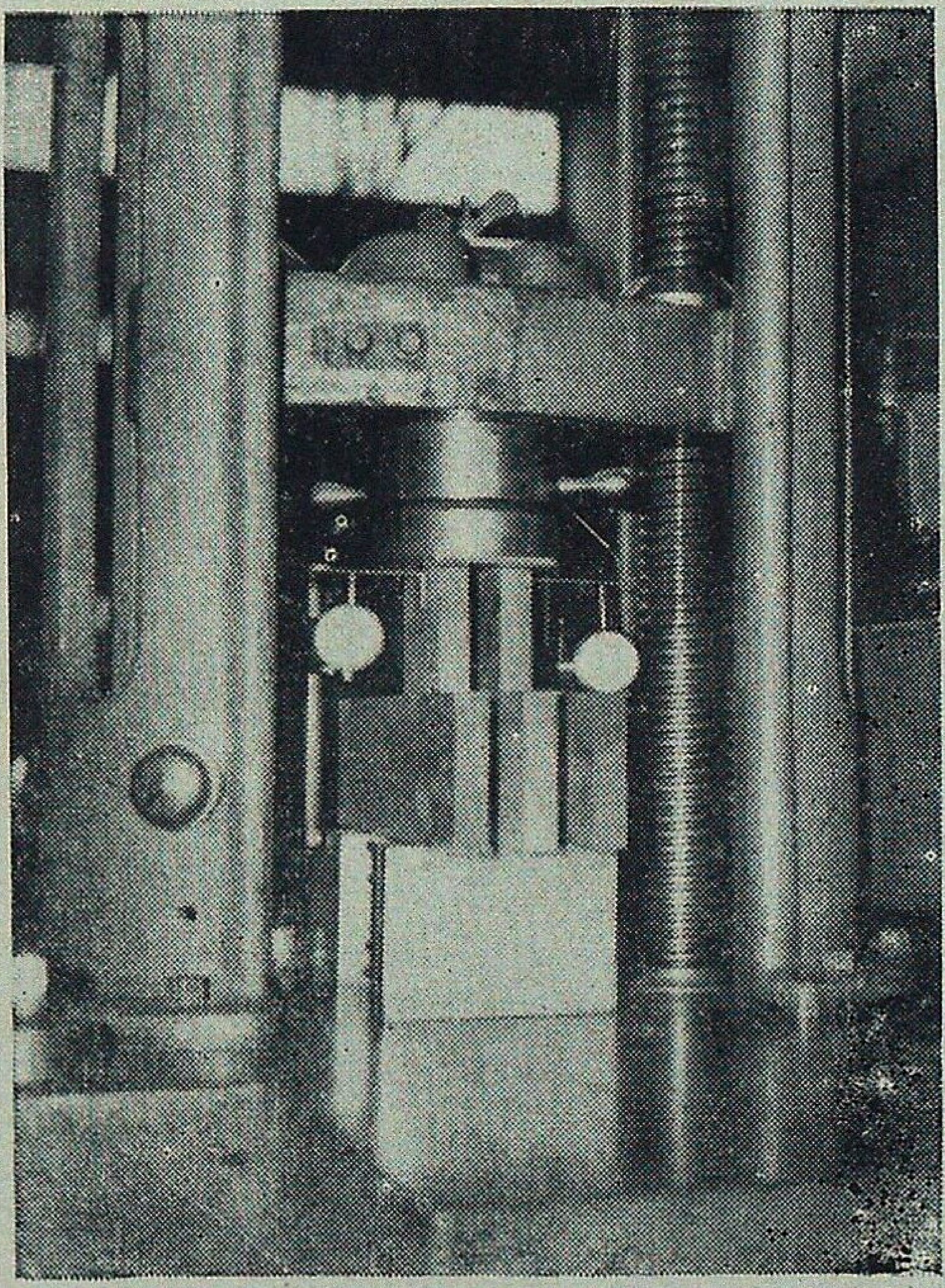
PLATE II (Cond.)

TESTING OF STRUCTURAL JOINT SPECIMENS IN COMPRESSION TESTING MACHINE

Joints loaded perpendicular to grain of wood

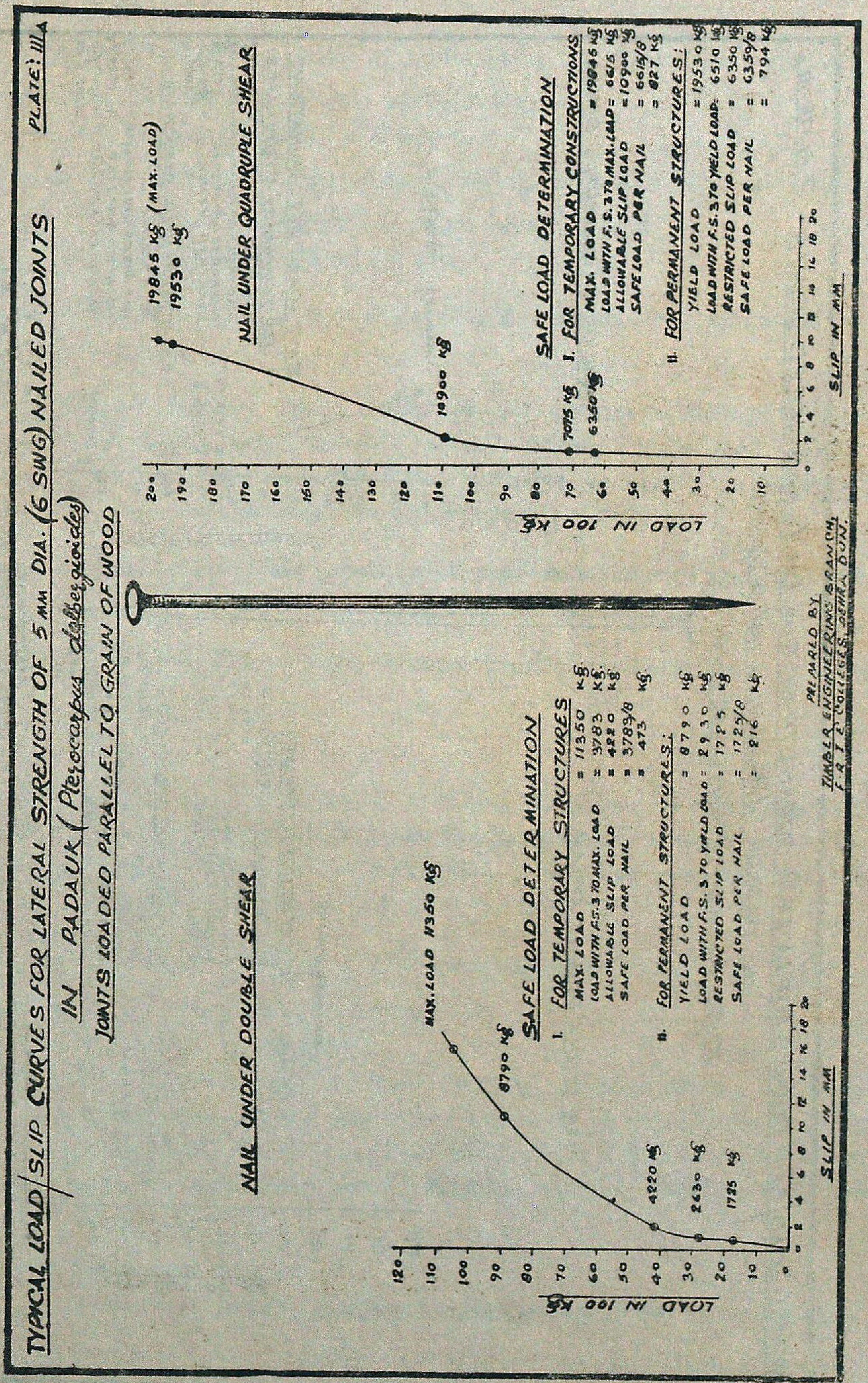


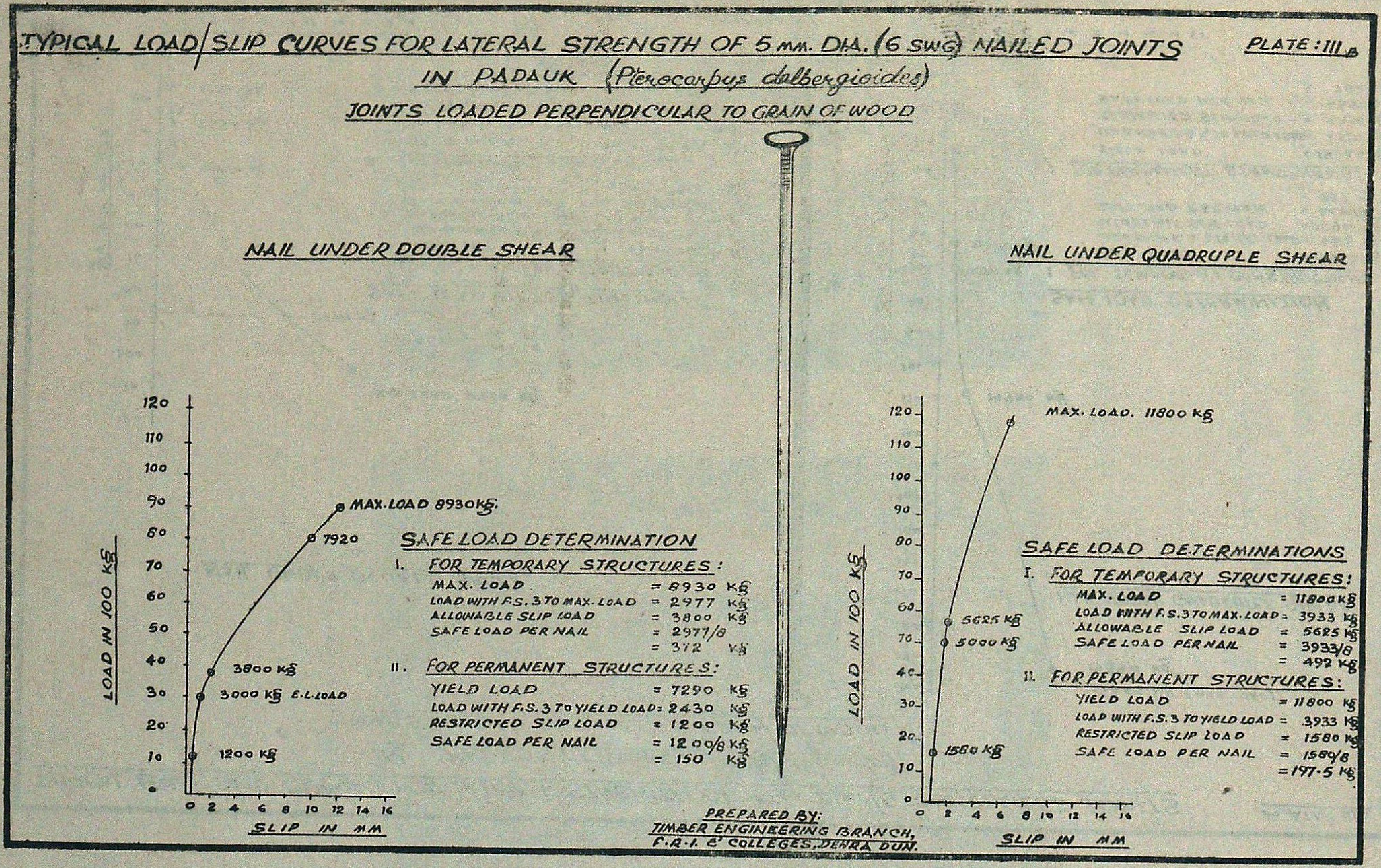
A typical double shear joint under test



A typical quadruple shear joint under test

DIAL GAUGE HELPS RECORD DEFLECTION READINGS UNDER INCREASING LOADS


TYPICAL LOAD/SLIP CURVES FOR LATERAL STRENGTH OF 5 mm DIA. (6 SWG) NAILED JOINTS
IN PADAUK (Pterocarpus dalbergioides)
JOINTS LOADED PARALLEL TO GRAIN OF WOOD
PLATE: III A
NAIL UNDER DOUBLE SHEAR
MAX. LOAD 11350 KG
8790 KG
4220 KG
1725 KG
LOAD IN 100 KG
SLIP IN MM
SAFE LOAD DETERMINATION
I. FOR TEMPORARY STRUCTURES
MAX. LOAD = 11350 KG
LOAD WITH F.S. 3 TO MAX. LOAD = 3783 KG
ALLOWABLE SLIP LOAD = 4220 KG
SAFE LOAD PER NAIL = 3783/8 = 473 KG
II. FOR PERMANENT STRUCTURES:
YIELD LOAD = 8790 KG
LOAD WITH F.S. 3 TO YIELD LOAD = 2930 KG
RESTRICTED SLIP LOAD = 1725 KG
SAFE LOAD PER NAIL = 1725/8 = 216 KG
NAIL UNDER QUADRUPLE SHEAR
19845 KG (MAX. LOAD)
19530 KG
10900 KG
7075 KG
6350 KG
LOAD IN 100 KG
SLIP IN MM
SAFE LOAD DETERMINATION
I. FOR TEMPORARY CONSTRUCTIONS
MAX. LOAD = 19845 KG
LOAD WITH F.S. 3 TO MAX. LOAD = 6615 KG
ALLOWABLE SLIP LOAD = 10900 KG
SAFE LOAD PER NAIL = 6615/8 = 827 KG
II. FOR PERMANENT STRUCTURES:
YIELD LOAD = 19530 KG
LOAD WITH F.S. 3 TO YIELD LOAD = 6510 KG
RESTRICTED SLIP LOAD = 6350 KG
SAFE LOAD PER NAIL = 6350/8 = 794 KG
PREPARED BY
TIMBER ENGINEERING BRANCH,
F.R.I. & COLLEGES, DEHRA DUN.


TYPICAL LOAD/SLIP CURVES FOR LATERAL STRENGTH OF 5 mm. DIA. (6 SWG) NAILED JOINTS
PLATE: III B
IN PADAUK (Pterocarpus dalbergioides)
JOINTS LOADED PERPENDICULAR TO GRAIN OF WOOD
NAIL UNDER DOUBLE SHEAR
LOAD IN 100 KG
SLIP IN MM
MAX. LOAD 8930 KG.
7920
3800 KG
3000 KG E.L. LOAD
1200 KG
SAFE LOAD DETERMINATION
I. FOR TEMPORARY STRUCTURES:
MAX. LOAD = 8930 KG
LOAD WITH F.S. 3 TO MAX. LOAD = 2977 KG
ALLOWABLE SLIP LOAD = 3800 KG
SAFE LOAD PER NAIL = 2977/8 = 372 KG
II. FOR PERMANENT STRUCTURES:
YIELD LOAD = 7290 KG
LOAD WITH F.S. 3 TO YIELD LOAD = 2430 KG
RESTRICTED SLIP LOAD = 1200 KG
SAFE LOAD PER NAIL = 1200/8 KG = 150 KG
NAIL UNDER QUADRUPLE SHEAR
MAX. LOAD. 11800 KG
5625 KG
5000 KG
1580 KG
SAFE LOAD DETERMINATIONS
I. FOR TEMPORARY STRUCTURES:
MAX. LOAD = 11800 KG
LOAD WITH F.S. 3 TO MAX. LOAD = 3933 KG
ALLOWABLE SLIP LOAD = 5625 KG
SAFE LOAD PER NAIL = 3933/8 = 492 KG
II. FOR PERMANENT STRUCTURES:
YIELD LOAD = 11800 KG
LOAD WITH F.S. 3 TO YIELD LOAD = 3933 KG
RESTRICTED SLIP LOAD = 1580 KG
SAFE LOAD PER NAIL = 1580/8 = 197.5 KG
PREPARED BY:
TIMBER ENGINEERING BRANCH,
F.R.I. & COLLEGES, DEHRA DUN.

Criteria for Safe Loads

1. For permanent constructions, lesser of the following two loads is the safe load :
   - (i) Load at factor of safety 3 to Yeild load.
   - (ii) Load at restricted slip of 0.4 mm.
2. For temporary construction; lesser of the following two loads is the safe load :
   - (i) Load at factor of safety 3 to Max. breaking load.
   - (ii) Load at allowable slip of 1.5 mm.

Thus the character of analysis is the safe load* of the test specimen as determined above from load-deflection diagrams.

Safe load data for different joints loaded parallel and perpendicular to the grain of wood for temporary and permanent conditions of use are statistically analysed. Table 2 gives mean values of safe loads under each of the four treatments alongwith the values of critical difference, significance level and bar diagrams, for temporary structures.

Table 3 gives mean values of safe loads under the four treatments alongwith the values of critical difference, significance level and bar diagrams, for paramanent structures.

In all the cases, quadruple shear joints behaved significantly better than the three series of double shear joints.

Discussion of Test Results

A comparative study for the effect of thickness of various members constituting the joints, i.e. double shear and quadruple shear joints, the relationship thereof and the indicative relation between two types of tests viz loaded parallel to grain and perpendicular to grain of wood for both temporary and permanent structures is as under :

1. Character of member thicknesses in double shear joints in Series A, B & C.

   (a) For joints loaded parallel to grain.

   (i) Temporary structures :

   The difference between load carrying capacity among three types of double shear joints has been found to be significant at 1% level of probability. However, joints under series B & C being under the same bar are not significantly different, general trend being C B A in a decreasing order.

   (ii) Permanent structures :

   There is no significant difference among three types of double shear joints.

*Safe lateral strength per nail for design of nail jointed timber construction is based on further statistical computations and analysis giving a range of minimum and maximum values as detailed in the articles mentioned at Serial No. 2 and 7 of the literature cited at the end.

Table 2

Giving mean safe loads (in kgs) significance level, C.D. values and Bar diagrams.

(For temporary structure)

Character		Mean-Values A	B	C	D	Significance	C. D.		Bar Diagram
ABC Series	Parallel to grain of wood	438.46 (5)	474.25	499.00 (14)	—	**	$n_1 = 5,\ n_2 = 14$	82.00	C B
							$n_1 = 14,\ n_2 = 14$	59.40	
	Perpendicular to grain of wood	352.30 (5)	387.39 (8)	377.27 (8)	—	N.S.			
ABCD Series	Parallel to grain of wood	438.46 (5)	474 25 (14)	499.00 (14)	746.16 (14)	***	$n_1 = 5,\ n_2 = 14$	152.52	D C B A
							$n_1 = 14,\ n_2 = 14$	110.65	
	Perpendicular to grain of wood	352.30 (5)	387.39 (8)	377.27 (8)	510.88 (8)	***	$n_1 = 5,\ n_2 = 8$	136.10	D B C A
							$n_1 = 8,\ n_2 = 8$	119.37	

Note :— Figures in brackets indicate number of observations upon which means are based.
N.S. indicates no significant difference.
** indicates significant difference at 1% level of probability.
*** indicates significant difference at 0.1% level of probability.

Table 3

Giving mean safe loads (in kgs) significance level, C.D. values and Bar diagram

(For permanent structure)

Character		Mean-Value A	Mean-Value B	Mean-Value C	Mean-Value D	Sig.	C. D.		Bar Diagram
ABC Series	Parallel to grain of wood	345.12	271.30	273.73	—	N.S.			
		(5)	(14)	(14)	—				
	Perpendicular to grain of wood	161.00	115.99	134.27	—	N.S.			
		(5)	(8)	(8)	—				
ABCD Series	Parallel to grain of wood	345.12	271.30	273.73	683.54	***	$n_1 = 5,\ n_2 = 14$	178.65	D $\overline{\text{A C B}}$
		(5)	(14)	(14)	(14)		$n_1 = 14,\ n_2 = 14$	129.61	
	Perpendicular to grain of wood	161.00	115.99	134.27	222.56	***	$n_1 = 5,\ n_2 = 8$	107.92	D $\overline{\text{A C B}}$
		(5)	(8)	(8)	(8)		$n_1 = 8,\ n_2 = 8$	94.65	

Note :— Figures in brackets indicate number of ovservations upon which means are based.
N.S. Indicates no significant difference.
*** Indicates significant difference at 0.1% level of brobability.

(b) For joints loaded prependicular to grain :

(i) Temporary structures :

There is no significant difference among three types of double shear joints.

(ii) Permanent structures :

There is no significant difference among there types of double shear joints.

2. **Quadruple shear (Series D) V/S double shear joints in different treatments**

Nails are preferred to carry multiple shear loads to the advantage of economic design using short length small dimensioned stocks of timber. Table 4 gives the relationship between double shear strength and quadruple shear strength as derived for such joints.

Table 4

Giving ralationship for quadruple sheer strength vs. double shear strength of nailed joints

Type of construction	Joints loaded parallel to grain of wood					Joints loaded perpendicular to grain of wood				
	Test Series			Significance	Average	Test Series			Significance	Average
	A	B	C			A	B	C		
Temporary	1.60	1.57	1.50	**	—	1.45	1.44	1.35	NS	1.40
Permanent	1.98	2.52	2.50	NS	2.30	1.38	1.92	1.66	NS	1.65

Note :—NS indicates no significant difference
** indicates significant difference at 1 % level of probability.

3. Indicative relationship for joint strength loading paralled and perpendicular to grain of wood.

As is evident, the safe loads per nail for perpendicular to grain loadings are lesser than those obtained when the joints are loaded parallel to grain. Table 5 gives the indicative relations between the two conditions in different treatments for temporary and permanent constructions expressed as the percentage of loads found from joints perpendicular to grain as compared to the loads from joints parallel to grain.

Table 5

Giving percentage for safe loaded perpendicular to grain as compared to that of parallel to grain nailed joints

Type of construction	Test Series				Significance for Series A, B, C.	Average of A, B, C (double shear)
	A	B	C	D		
Temporary	80%	82%	75%	68%	**	—
Permanent	47%	43%	49%	32%	NS	46%

Note :— **** indicates significant difference at 1% level of probability.**
NS indicates no significant difference.
Percentage figures rounded to nearest whole number.

Conclusion

The limited laboratory tests carried out have indicated that the effect of relative thickness of members constituting mono-chords, split-chords in timber construction, and the possible relation for double shear and quadruple shear resistance of nails would rationalizing the design of nail jointed units and set the trend for tests in determining nail-strength data of 5 mm dia nails in different structural timbers.

Till some more generalised conclusions are obtained between joint strength for varied types of loadings for different nails and timber species, the relationship derived above under a controlled study may safely be taken as indicative of the trend for any possible criteria, that may be required in the design calculations of nail-jointed timber structures. Indications of the relation between loads parallel and perpendicular to grain of wood studied here could, obviate in the long run, the necessity of detailed testing for both types of loadings in different types of shear joints for any field problems.

Acknowledgements

The tests involved in the above investigation were carried out with the help of Officer-in-Charge, T.M. Branch and his Laboratory Staff and Statistical design/analysis done with the help of Officer-in-Charge Statistical Branch and his Staff for which grateful thanks are expressed here. Thanks are also due to Shri R.C. Kukreti, Jr. Draftsman, T.E. Branch for preparing drawing plates for this paper. The paper is published with the kind permission of Director, Forest Product Research, Forest Research Institute, Dehra Dun.

SUMMARY

Techniques of nail-jointed timber structures are now well-known for their role in promoting the utilization of short length small dimensioned stocks of timbers, simplicity of fabrication and economy in construction costs. In the present work on nailed joints an attempt has been made to detrmine the relationship through actual laboratory tests, between strength of 5 mm dia 150 mm long common wire nails under four different conditions of member thicknesses (double shear and quadruple shear joints) in Padauk (*Pterocarpus dalbergioides*) and two types of grain loadings. The data obtained may be applied in design problems of nail-jointed units for determining multiple shear strength of nails when their double shear strength is known and vice versa for temporary and permanent type of constructions.

टैरोकार्पस डलबर्जिआयडिस की संरचना संधियों में अवयवों को विभिन्न मोटाइयों (दुहरा और चौहरा कर्तन बल) में 5 मिमी० व्यास की सामान्य तारकीलों की शक्ति का अध्ययन

लेखक के०एस० प्रुथी व ए०एन० बजाज

सारांश

कम लम्बाई की छोटे नाप वाली लकड़ियों का उपयोग बढ़ाने, निर्माण की सरलता और निर्माण की लागत में बचत में अपनी भूमिका के कारण कील योजित प्रकाष्ठ संरचना प्रविधियां भली भांति प्रसिद्ध हैं। कील संधियों पर किए गए इस कार्य में वास्तविक प्रयोगशाला परीक्षणों द्वारा अवयवों की मोटाइयों की चार विभिन्न दशाओं (दुहरा और चौहरा कर्तन बल) में 5 मिमी० व्यास की 150 मिमी० लम्बी सामान्य तारकीलों की शक्तियों का पारस्परिक सम्बन्ध पडौक (टैरोकार्पस डलबर्जिआयडिस) और दो प्रकार का अन्नभार डाल कर निश्चित करने का प्रयत्न किया गया है। इस प्रकार प्राप्त हुए आंकड़ों को अस्थायी और स्थायी प्रकार की संरचनाओं के लिए कील योजित इकाइयों की आकलन समस्याओं में कीलों की बहुकर्तन शक्ति निश्चित करने के लिए प्रयुक्त किया जा सकता है जहां उनकी दुहरी कर्तन शक्ति ज्ञात हो अथवा उसकी प्रतिवर्ती स्थिति हो।

References

Bajaj, A.N., K.S. Pruthi, R.K. Punhani and Harbax Singh (1978). A note on the lateral strength of 5 mm dia (6SWG) common wire nails in different species for design of timber structures. *Ind. For.*, **106** (7) : 496–509.

IS : (2366-1963). "Code of practice for nail-jointed timber construction" (currently under revision).

Masani, N.J. and S.K. Agarwal (1964). Some fundamental aspects regarding lateral strength of ordinary wire nails used as connectors in timber construction-*IFL* 170.

Masani, N.J., A.N. Bajaj, R.K. Gupta, S.K. Agarwal, B.D. Goyal and Bhagirath Pd. (1963). Research report on nail joints in timber structures, Part II. *A joint publication of FRI and NBO.*

Masani, N.J., K.S. Pruthi, S.K. Agarwal (1967). Design data on nail joints in timber structures through research solutions in *Pinus roxburghii* (Chir) *IFL* 181.

Masani, N.J., K.S. Pruthi, Sunder Lal and Bhagirath Pd. (1971). Research report on Nail joints in Timber Structures, Part III *–A joint publication of FRI and NBO.*

Masani, N.J. S.K., Agarwal and G.R. Malhotra Pd. (1965). Research results on lateral strength of nails in structural timber joints (Part II) *IFL* 179.

———

LETTER TO THE EDITOR

To

Honorary Editor,
Indian Forester,
P.O. New Forest, Dehra Dun.

Sub :– **Yield of *Eucalyptus tereticornis* as influenced by spacing pattern**

Dear Sir,

Eucalyptus tereticornis is the most common species planted under Social Forestry Programmes along road sides, on perphery of cultivated fields and under agro-forestry where inter-spaces are utilised for growing agricultural crops. The pattern of spacing under these situations is different than raising this species under forestry conditions. Only few lines are planted along road, canal and railway line plantations. In agro-forestry, the width of interspacing between lines is most important.

There appears to be no Indian literature to guide as to what pattern of spacing should be adopted so as to obtain maximum yields under these situations. The other day I was going through the publication "Studies on spacing in *Eucalyptus* plantations, U.P. Forest Deptt. Bulletin No. 42, Research & Development Circle, Lucknow (1980)" by Shri D.N. Lohani, summerising the results of numerous spacing trials carried out in Uttar Pradesh. I feel no where in India so many trials to isolate the effect of spacing has been conducted and results brought together at one place.

A perusal of the results of the experiments indicate that rectangular spacing for *Eucalyptus tereticornis* tends to give higher yields. How much is the superiority of rectangular spacing over square is not indicated. Taking advantage of 60 observation of various spacings given in Appendix II of the above publication, I have attempted in deducing influence on yields by spacing pattern.

The following gives the mean and standard deviation of parameters used in the regression :

Parameter	Mean	Standard deviation	Denoted by	Unit
Age	6.29	1.7	A	year
Volume/ha	84.29	42.54	V	m^3
Spacing	2.72	0.86	S	m
Survival %	79.9	12.4	SU	%
Spacing ratio	1.59	0.68	T	—
Number of observations	55	—	N	—

Note :–1. Spacing ratio (T) is larger distance of rectangular spacing divided by square root of growing space per tree.

2. Spacing (S)–is effective spacing at perticular time and is equal to initial spacing divided by square root of the fraction of surviving trees. For 100% survival initial spacing is the effective spacing.

3. Instead of 60 observations, 55 were utilised after rejecting 5 observations where growth has been very poor. These were rejected by the study of Residual/Y-estimate graph.

The following regression was found to fit data the best –

$$\text{Log } V = -.65674\ S + .03651\ S.A. - .42501/T + 5.72061$$

$$r = .859$$

t — value for

regression coefficients 9.728, 5.135 & 2.806 respectively.

The value of coefficient of correlation (r) is low because top height of plots is not known and so site index as independent variable could not be used as independent variable.

It should be noted that the above regression *is not the growth function.* In basic data there are observations mostly for 6 and 7 years of age.

Observations	Age (yrs)
34	6
13	7
5	10
3	12
55	

Therefore the regression will predict the effect of spacing pattern on yield of Eucalypts well for narrow range of 6 to 7 years only. The following gives the influence of spacing pattern on yield of Eucalypts.

Age of plantation 7 years

Growing space (m^3)	Spacing (m)	Yield/ha (m^3)	Percentage of square spacing (%)
4	2.00×2.00 Square spacing	89.41	100
	2.82×1 41 rectangular spacing	101.17	113.2
	3.45×1.15 ,, ,,	106.89	119.6
	4.00×1.00 ,, ,,	110.59	123.7

It would be seen that by putting plants 1 m apart in line and keeping 4 m distance between lines gives 23.7% higher yield in tarai region of Uttar Pradesh as compared to square spacing.

It extension forestry programmes the results of this analysis are worth considering. The distance between the plants can be kept small, while between the rows can be increased to get best results. Probably availability of more lateral light to individual plants may be responsible for better growth.

Yours faithfully,
Sd./- S.P. Singh
Assistant Silviculturist,
Forest Management & Mensuration Branch,
F.R.I. & Colleges, Dehra Dun.

————

GAZETTE NOTIFICATIONS

F.R.I GAZETTE

The President, F.R.I. & Colleges, is pleased to appoint Shri R.S. Shah, R.A. I (S.G.) to the post of Asstt. Mensuration Officer in a Temporary capacity w.e.f. 18.6.82, until further orders.

The President, F.R I. & Colleges, Dehra Dun, is pleased to appoint Shri Nirmal Ram, R.A. I (S G.), M.F.P. Branch, to the post of Research Officer in Environmental Research Station, Siliguri w.e.f. 24.7.82 until further orders.

KARNATAKA GAZETTE

The services of Shri N V. Ramachandra Chetty, IFS, Officer of Karnataka Cadre are placed at the disposal of Government of India for appointment as Joint Director, Forest Survey of India, Southern Zone, Bangalore.

WEST BENGAL GAZETTE

The Governor is pleased to appoint the following Officers, until further orders

1. Shri Anil Kumar Ghosh, W.B.J.F.S., Assistant Divisional Forest Officer, East Midnapore Division, as Divisional Forest Officer, Durgapur Social Forestry Division, with effect from the date of his assuming charge.

2. Shri M. Chatterjee, W.B.J.F.S., Asstt. Divisional Forest Officer, Jalpaiguri Divssion, as Divisional Forest Officer, Soil Conservation Division (North), with effect from the date of his assuming charge.

3. Shri N. Sarkar, W.B.J.F.S., Asstt. Divisional Forest Officer, 24-Parganas Division, as Divisional Forest Officer, Kharagpur Social Forestry Division, with effect from the data of his assuming charge.

4. Shri S. Das, W.B.J.F.S. (Offg.), Asstt. Divisional Forest Officer, Purulia Division as Divisional Forest Officer, Siliguri Social Forestry Division, with effect from the date of his assuming charge.

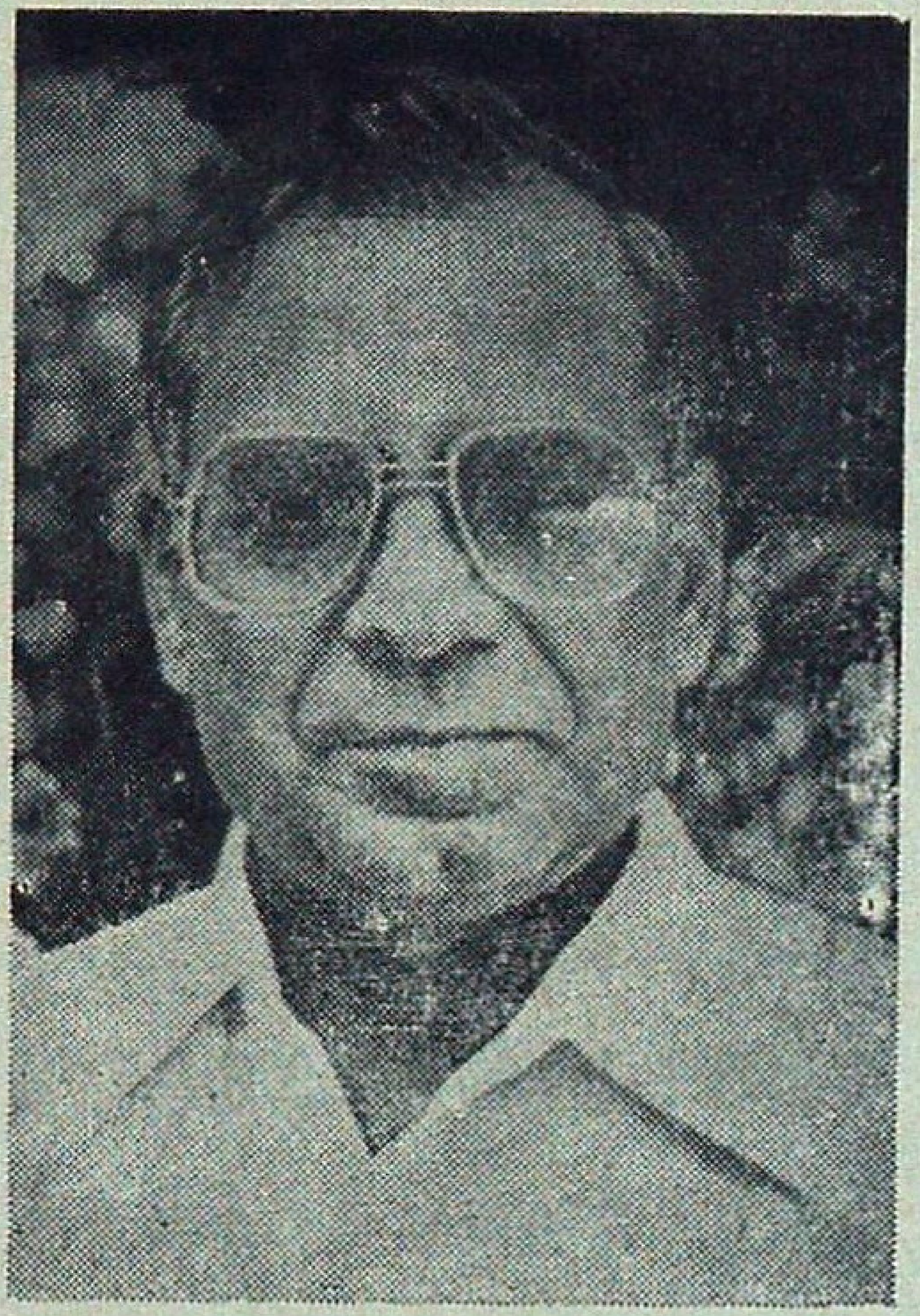
5. Shri Atindra Kumar Ghosh, W.B.J.F.S. (Offg.), Asstt. Divisional Forest Officer, Cooch Behar Division, as Divisional Forest Officer, Raigunj Social Forestry Division, with effect from the date of his assuming charge.

OBITUARIES

(I)

Janardhan Sadashiv Burkule

(1928-1982)



Death brought an abrupt and untimely end to the promising career of Shri Janardhan Sadashiv Burkule, Deputy Conservator of Forests, on Saturday, August 21, 1982 at Thane near Bombay, who succumbed to a sudden stroke of the heart. He would have been 54 years of age on November 22, 1982.

He had a distinguished academic career, having graduated in Science with a First Class, from Karnatak College Dharwar. Choosing forestry as his career, he entered the Forest Service in the erstwhile Bombay State on 25.5.1951 after completing successfully a Course of Forestry in the Rangers' Forest College, at Dharwar. He made his mark by his total integrity, infinite capacity for work, unremitting application, zeal and earnestness. A fine sense of duty and a passion to excel in whatever he did, characterised his work. Deservingly therefore, he was promoted as Assistant Conservator of Forests in 1965. Soon after, he was, promoted as Deputy Conservator of Forests in 1970, in which capacity he served in Bhandara, Shahapur and Thane Forest Divisions, leaving a clear impress of his administrative and professional acumen and competence. By virtue of his meritorious service record, he was encadred in the Indian Forest Service. He was on deputation to the Forest Development Corporation of Maharashtra as the Divisional Manager of the prestigious Sanjay Gandhi National Park at Borivali, where he brought about significant improvemnt, specially in regard to the Lion Safari, which has now 25 full-grown lions and toned up the efficiency of management of this Park through his innovative approach and enforcement of discipline. He brought about active public participation in the development of this Park through the Wildlife Wanderers' Nature Foundation. Experiments in breeding crocodiles and hyenas were initiated during his tenure, the success of which brought credit to the Park. He brought order and discipline to the Park and freed it from the influence of anti-social elements. He was lately deputed to the State Anti-Corruption Bureau at Bombay as Deputy Director which post he held till his demise.

He had a keen intellect and was well-versed in Sanskrit. In his own mother tongue namely Marathi, he was an eloquent speaker and writer and could express his views vigorously with lucidity and feeling.

The Forest Department bemoans the loss of a talented and conscientious officer.

May God graut solace and succourt o his bereaved widow and children and other dear members of his family whom he has left behind to mourn his loss.

L.H.A.R

(II)

Vithal Dhondiba Magre
(1929-1982)

We regret to announce the sad news of the demise of Vithal Dhondiba Magre on 12th April, 1982 at Dahanu in Thane District, after a long illness patiently borne. He was a victim of the dreadful disease of cancer of the lungs, against which he battled heroically till the last. He was 53.

After grduating in Agriculture from the College of Agriculture, Pune, he had a brief stint in the Agriculture Department and later entered the gazetted State Forest Service in 1955. As Assistant Conservator of Forests, he served in various Forest Divisions in Thane, Dangs (now in Gujarat), Dhule and Raigad districts till March, 1960, in each of which he left a mark of his industry and assiduity. He was promoted as Deputy Conservator of Forests in April, 1960, in which capacity he served in Aurangabad, Thane, Jalgaon, Yawol and Dhanu Forest Divisions. He was encadred in the Indian Forest Service in 1966. The hallmark of his work was dynamic zeal, a forward-looking approach and unremitting application He was also a perfectionist and whatever he accomplished revealed a keen and meticulous eye for detail, finesse and excellence. The exquisite complex of forest and deer parks, suspension bridge and the rest houses set up by him at Pal in Jalgaon District and the extensive forest nursery established by him at Kasa, a model in imaginative lay-out and stocking, bear eloquent testimony to his signal achievement and are often referred to with praise and acclaim. His innovative spirit ever sought pastures ainew and showed a remarkable freshness of outlook and originality in approach. Truly did he trade well with his talents.

He was deputed to Dehra Dun, for a short-term course in logging in 1966 and to the United Kingdom in 1969-70 for a refresher course in Forestry at the Oxford University in which he acquitted himself well. The training in logging stood him in good stead, on his deputation to the Forest Development Corporation in the State, as its Deputy Director. He was promoted as Conservator of Forests in charge of Chandrapur Forest Circle from 1976 to 1978. Thereafter, he was placed in charge of the Working Plans Circle at Pune, in which he served till his demise.

The State Forest Department has lost a talented and dynamic officer, in the premature demise of Shri Magre.

He had a genius for companionship and was ever helpful to his colleagues, staff and friends.

May God grant his departed soul everlasting peace and solace to his bereaved widow, children and relatives.

L.H A R.

FRI Publications

FOREST RESEARCH INSTITUTE AND COLLEGES DEHRA DUN

Indian Forest Records

Vol. 14, No. 2—*Entomology* : Revision of termite genus OJontotermes Holmgren (Isoptera : Termitidae : Macrotermitinae) from India, by M.L. Thakur. PFRI. 23. XIV. 2.
Rs. 40.00 or £ 5.00 or $ 15.00·

Other Publications

Troup's—The Silviculture of Indian Trees, Vol. II—Dipterocarpaceae Revised and enlarged by H.B. Joshi. PFRI. 170. Rs. 41.50 or £ 4.85 or $ 14.95.

Symposium Proceedings : Silviculture, management and utilisation of Poplars, October, 15–18, 1979, Srinagar, Ed. by R.V. Slngh. PFRI. 185.
Rs. 114.00 or £ 13.30 or $ 41.04

Economical timber trusses for industrial buildings, (13 to 15 Metres), by R.K. Gupta, R.K. Punhani, Sudhir Gupta and R.C. Kukreti, PFRI. 182.
Rs. 22.50 or £ 2.62 or 8.10

Available from **:—The Controller of Publications, Department of Publications, Civil Lines, Delhi–110054**

"WOOD IS GOOD"

So is Asian Wood

With best compliments from **:**

Asian Woods & Polymers (P) Ltd.,

Long Island, Middle Andaman–744203

FOREST DEVELOPMENT CORPORATION OF MAHARASHTRA LIMITED, NAGPUR.

(A Govt. of Maharashtra Undertaking)

We produce in bulk

- Quality teak for plywood, veneering and saw milling.
- Valuable non-teak logs and poles for various uses.
- Bamboos.
- Firewood.
- Industrial grade charcoal, Khair wood & Ain bark.

For particulars, contact :—
The Regional Manager,
Research & Marketing,
Forest Development Corporation
of Maharashtra Ltd., Nagpur—440010.

HIMACHAL PRADESH STATE FOREST CORPORATION LTD.

KANWAR NIWAS, NEW LAND ESTATE, SIMLA—1

(A H.P. GOVERNMENT UNDERTAKING)

Manufacturers of:—HIMROSIN (ISI), TURPENTINE, PHENYLE, VARNISH.

Exporters of:—HIMROSIN, PHENYLE, VARNISH.

Suppliers of: HIGH QUALITY WATER-BORNE TIMBER—**Logs, Sleepers, Scants & Hakaries of** DEODAR, KAIL, FIR AND SPRUCE.

We have achieved :

* Complete nationalisation in resin tapping in Himachal.
* Partial nationalisation of timber trade in Himachal.
* Scientific exploitation, economic harnessing and maximum utilisation of forest resources in the State.
* Social justice to forest workers.
* Increased employment potential in our rosin & turpentine factories.
* Substantial contribution in the setting up and development of forest-based industries in Himachal through our HIMKASHTH Sales Depots at Parwanoo, Bilaspur, Paonta Sahib, Yamuna Nagar and Nurpur.

A.K. Mukerji, I.F.S.
Managing Director

Ram Nath Sharma
Chairman

1/82—12/82

We have pleasure to introduce ourselves as :

* Producers of Round Timber for Veneering and Saw Mill.
* Manufacturers of Tea chests and Commercial Plywood.
* Supplier of Sawn Timber and Furniture.
* Cultivators of Coffee, Cardomom, Rubber, Cocoa, Tea and other cash crops.
* Manufacturers of Match and Polythene Bags.

Arunachal Pradesh Forest Corporation Limited

(A Govt. of Arunachal Pradesh Undertaking)

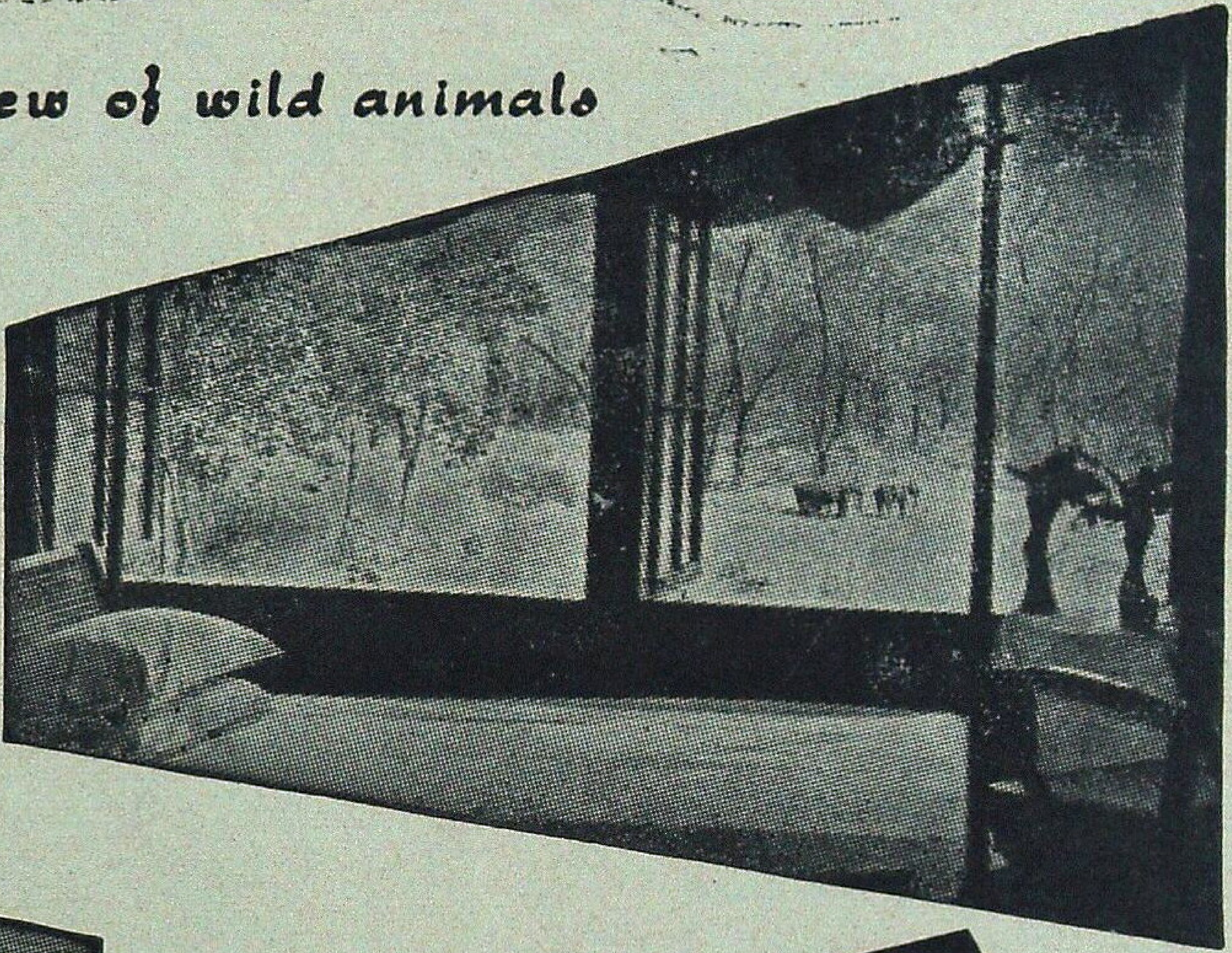
DEOMALI

Regd. Office :—
ITANGAR—79111
Distt. Sabansiri
(Arunachal Pradesh)

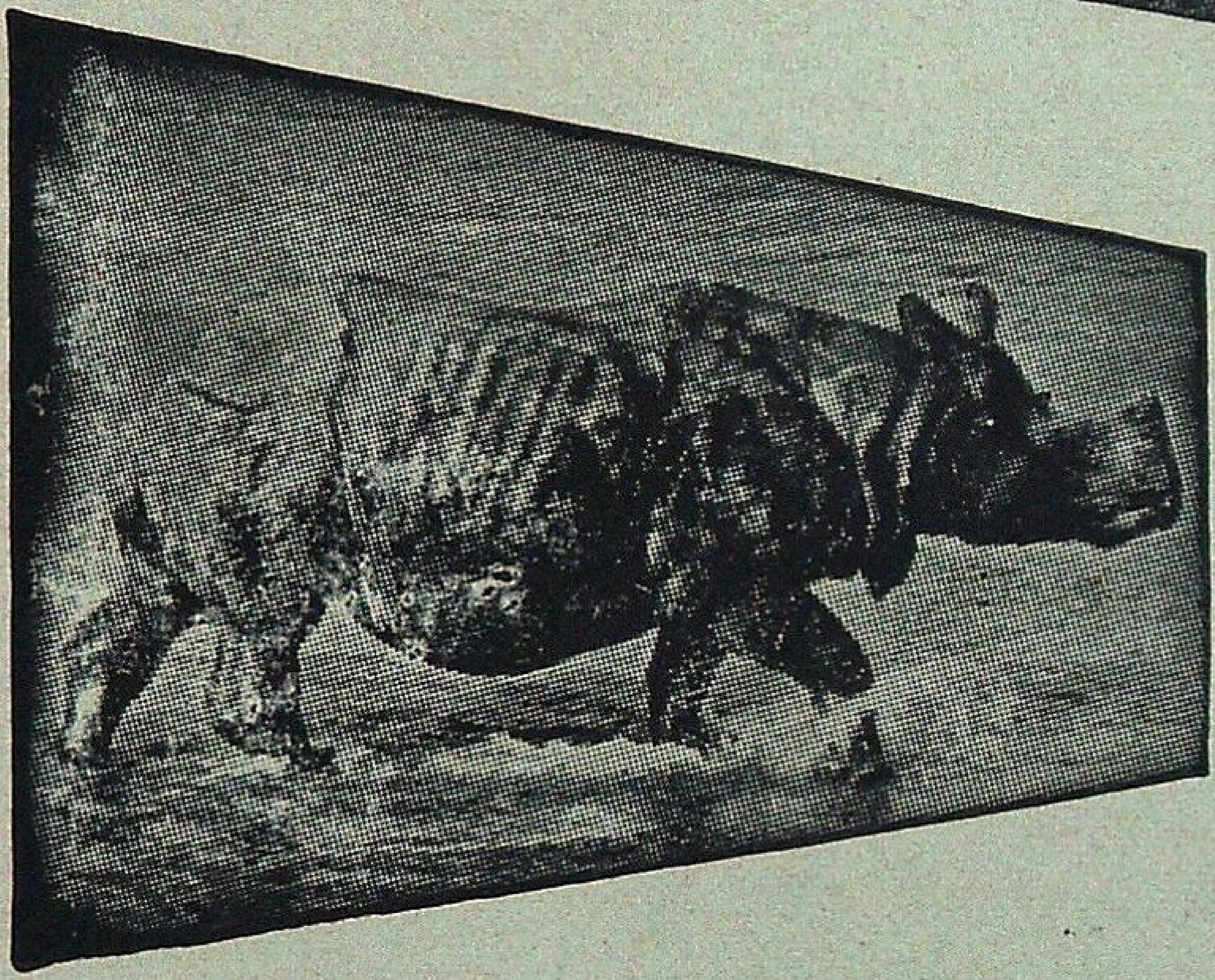
Head Office :—
P.O. Deomali-786629
Distt. Tirap
(Arunachal Pradesh)

1/82–12/82

Have a bedroom view of wild animals



VISIT



JALDAPARA WILD LIFE Sanctuary

* Home of One-horned Rhinoceros.
* Gaur, Elephants, Tigers.
* Varieties of Deer and other Animals
* Furnished Tourist Lodges with full Catering arrangement.
* Approachable by Road, Train and Air.
* Jeep available.

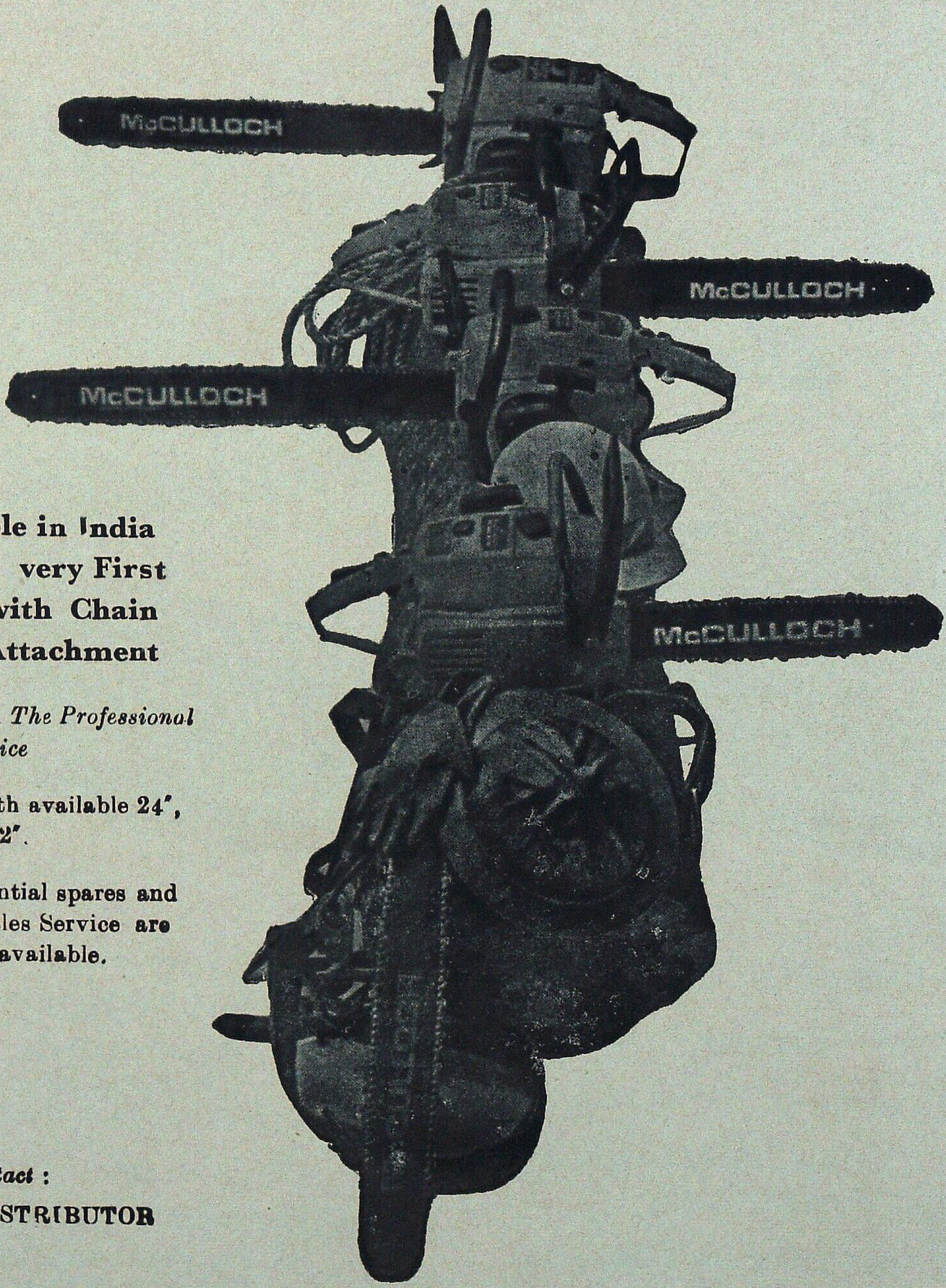
Please contact :

DIVISIONAL FOREST OFFICER
COOCH BEHAR
[Phone C.B. 247]
WEST BENGAL

OR

FOREST UTILISATION OFFICER
8, Lyons Range, CALCUTTA
[Phone : 22-2774]
WEST BENGAL

3/372/33 –



Available in India for the very First Time with Chain Brake Attachment

McCulloch. The Professional Dealer Choice

1. Bar lenth available 24", 28" & 32".

2 All essential spares and after Sales Service are readily available.

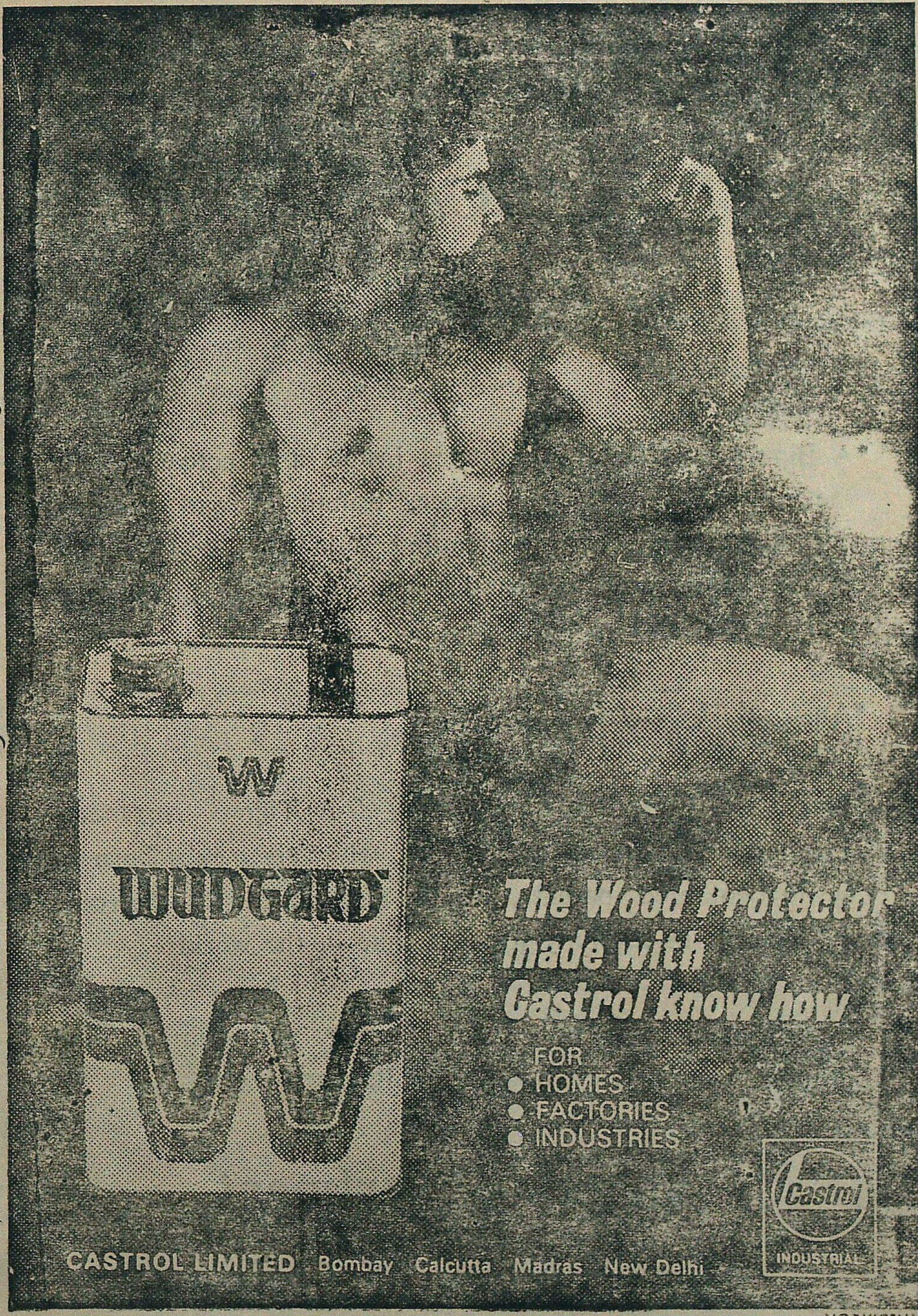
Please Contact :

"SOLE DISTRIBUTOR in India".

M/s. INDIANA INTERNATIONAL

2001, Ugger Sen Street, Bazar Sita Ram, Delhi—110 006.

Phone : 264868. 261250 **Grams :** "POWERCHAIN"


W
WUDGARD
The Wood Protector
made with
Castrol know how
FOR
● HOMES
● FACTORIES
● INDUSTRIES
Castrol
INDUSTRIAL
CASTROL LIMITED Bombay Calcutta Madras New Delhi

NORVICSUN

NANDANKANAN

BIOLOGICAL PARK

INVITES YOU

*A Bioaesthetic Complex situated inside a Sanctuary......In the relaxing environs of peace, tranquility and soothing natural beauties......Its enchanting Wild Life......Attraction of the shore walk under the shady groves along the lake and Elephant Ride, etc. etc.

*An ideal Holiday Resort.

*Please see the spot of rare events of a Tigress surrendering her independence......The five white tiger cubs born to normal-coloured parents......and also successful breeding of gharials in captivity for first time in the world.

*Approachable by rail from Barang and Cuttack and Bhubaneswar and by Road from Bhubaneswar.

Forest Department

Government of Orissa

The Moments of Life Time Experience await you—

IN SASAN-GIR

you have a date with the

King & Queen

of Animal World

The most Majestic Royal Animal species—

The Rare Asiatic Lione

For more det ils contect:

Deputy Conservator of Forests,
Wild Life, (SASAN-GIR)
P n—362135
Saurashtra (Gujrat State) Phone—60, Visavada

4/82—12/82

The Similipahar Forest Development Corporation Ltd.

(A GOVERNMEMT OF ORISSA UNDERTAKING)

CUTTACK—Pin: 753002

Aims at :

- Preservation of Eco-system. Replacement of mixed miscellaneous forests by more valuable species.
- Increasing production of raw materials for forest-based industries.
- Promoting market for heitherto untapped resources.
- Reducing social, economic and regional imbalances.

and

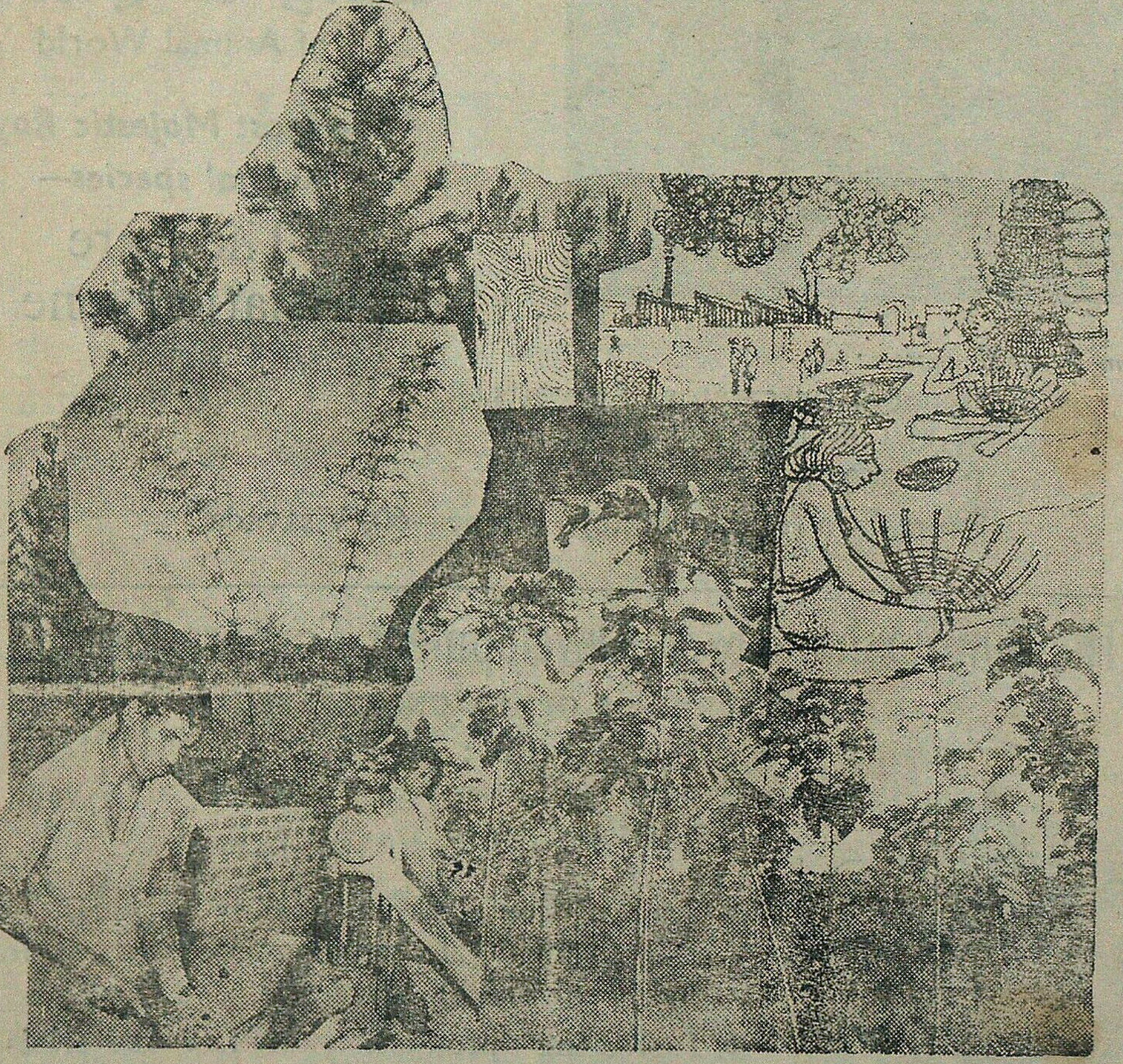
- Creating new employment avenue.

1/82—12/82

FROM FOREST-BASED COTTAGE UNITS

TO HEAVY WOOD-BASED INDUSTRIES
WE PLAN FOR AND CATER TO

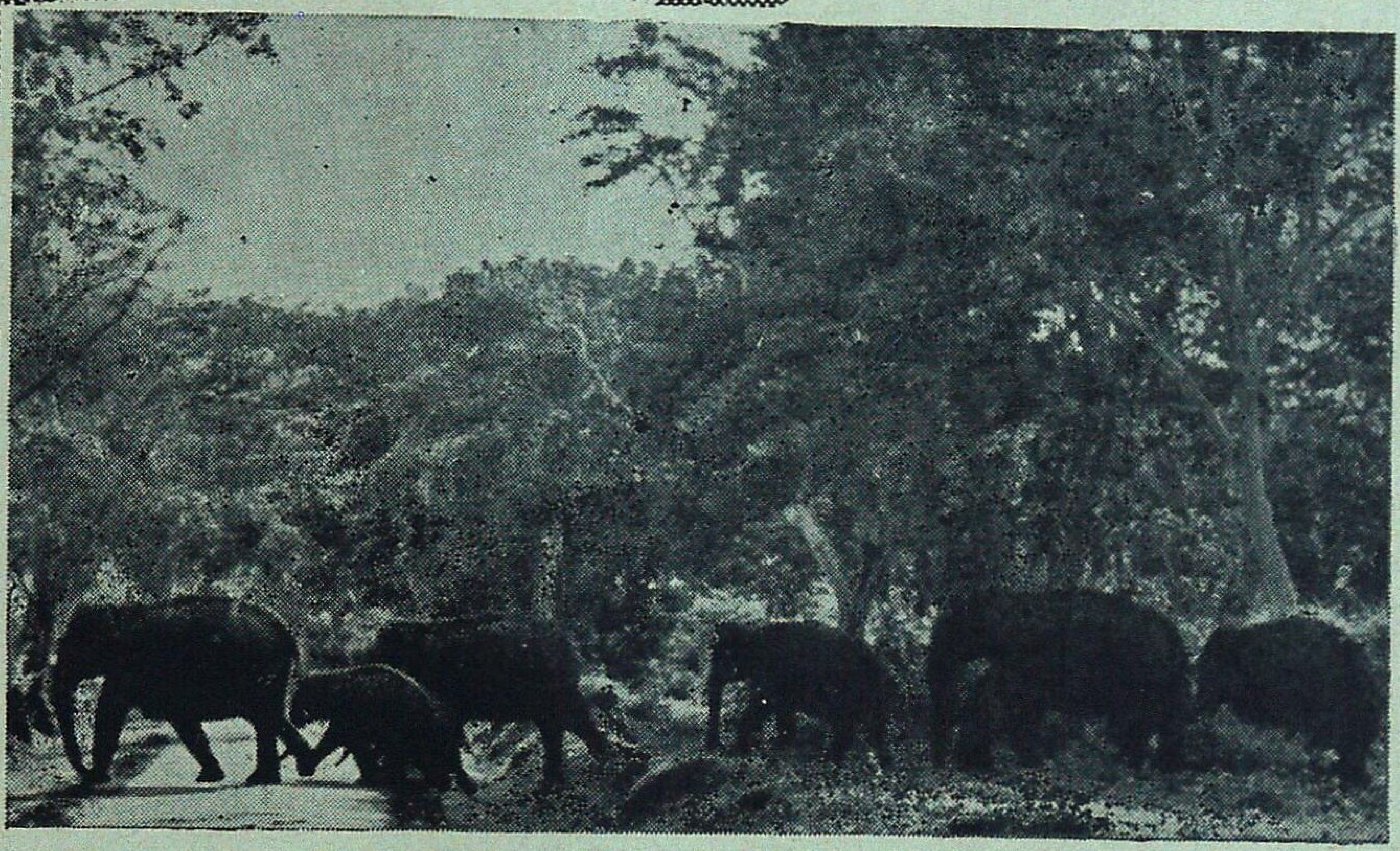
REALIZATION OF FULLEST POTENTIAL OF FORESTRY SECTOR IS OUR AIM.



TURN-OVER RAISED TO TEN TIMES DURING LAST YEARS.
OVER 20000 HAC. OF TEAK-BAMBOO-PINE PLANTATION RAISED.
WOOD-WORKING UNITS TO SPREAD SKILL AMONG RURAL ARTISANS.
WOOD-PROCESSING COMPLEXES AT ITARASI AND JAGDALPUR.
FOREST-BASED TRIBAL-ORIENTED DEVELOPMENT OF BASTAR THROUGH
THE M P FORESTRY TECHNICAL ASSISTANCE PROJECT AT JAGDALPUR.
DISTRIBUTION OF WAGES TO THE TUNE OF RS 800 MILLION TO ABOUT 50000 PERSONS

THE BIGGEST AMONG THE FOREST DEVELOPMENT CORPORATIONS IN INDIA
MADHYA PRADESH STATE FOREST DEVELOPMENT CORPORATION LIMITED
PANCHANAN, MALVIYA NAGAR, BHOPAL

MPSFDC



MUDUMALAI WILDLIFE SANCTUARY

MADRAS STATE

Best Visiting Time: APRIL—JUNE

40 miles from Ootacamund and 60 miles Mysore connected by Public Bus Service

Nearest Airport: COIMBATORE
Nearest Railway Station: OOTACAMUND

Noted for variety wildlife and Picturesque Scenery, ideal Holiday resort

Fully Furnished Forest Rest Houses
Cooks attached, Meals served on
Advance Booking and
Elephant and Jeep for Joy Rides available.

For Reservation & other Particulars write to:

WILDLIFE WARDEN
Mudumalai Sanctuary,
Coonoor Road, Ootacamund-1

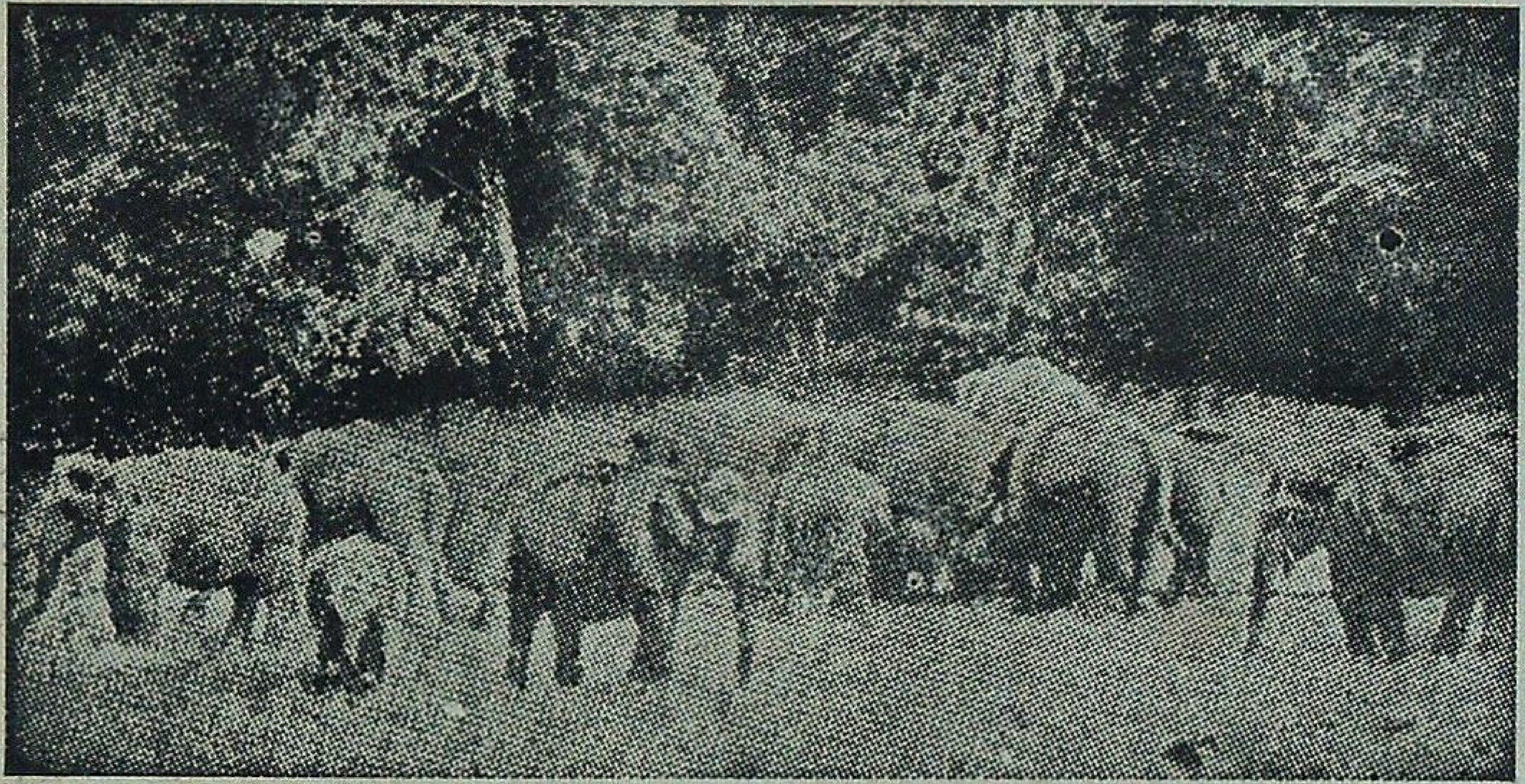
VISIT : **The Periyar Wild Life Sanctuary,**

THEKKADY (KERALA STATE)

(OPEN ALL YEAR)

OBSERVE

Elephants, Gaur, Sambhar Leopard, Wild Dogs, Black Langur, The Giant Malabar Squirrel, Birds and other indigenous Fauna.



—

Hotels :

Western Style—Aranya Nivas

Indian Style—Periyar House.

(Accommodation in Hotels reserved by Managers)

†Furnished Forest Rest Houses at Thannikudy, Mullakudy and Manakavala.

†Motor Boats available for most enjoyable cruise in the lake.

†Elephant rides.

†Approachable by Air or Rail up to Cochin or Madurai.

Distance to Thekkady by road is 190 KMs. from Cochin, 145 KMs. from Madurai and 110 KMs. from Kottayam.

For further particulars contact :—WILD LIFE PRESERVATION OFFICER
Thekkady P.O., Kerala State
Telephone : KUMILY 27

2/82—1/83

FOR ROPING AND PLANTING TREES

POLYTHENE BAGS

GUSSETTED-PERFORATED OR PLAIN

Contact for Immediate Supply

KANPUR PLASTIC COMPANY

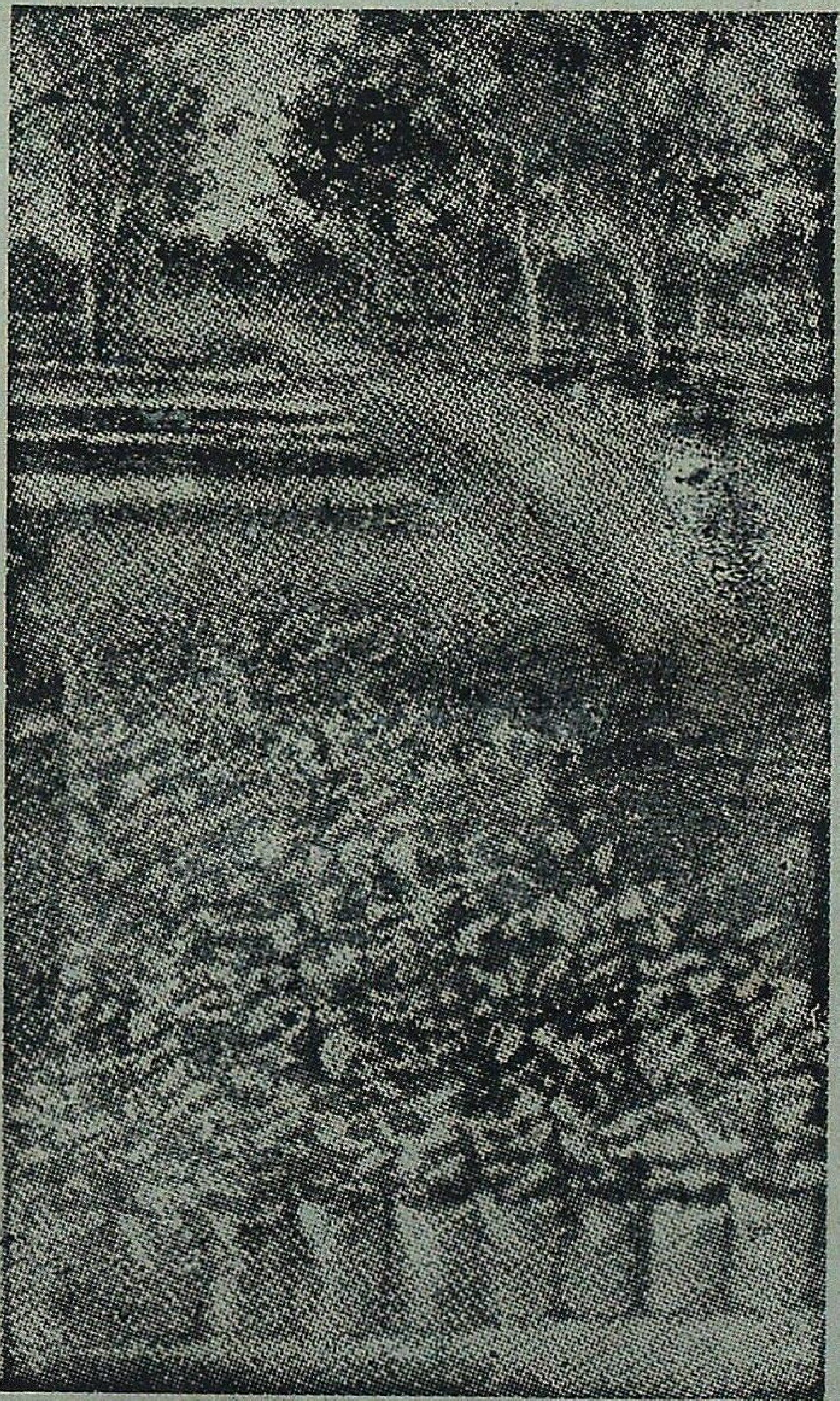
111/423, Ashok Nagar, KANPUR—208012

Phones { Office : 43721 & 44992
Resi. : 81569 Gram—KANPLASTIC
Fac. : 44993 Estd.—1956

—

ALL SIZES OF POLYTHENE BAGS IN REQUIRED GAUGE & SPECIFICATIONS AVAILABLE

1/82—12/82



J & K STATE FOREST CORPORATION

(A GOVERNMENT OF J & K UNDERTAKING)

J K S.F.C. is the sucessor to Government Lumbering Undertaking, a well known and popular name in the timber trade circles. Presently responsible for 60% extraction of timber in the Valley and 40% in the Jammu Region the Corporation has plans to take over complete Forest Working in 1982 and 1986 in Kashmir and Jammu region respectively. It is a labour oriented undertaking of the J & K Govt. employing over 20 Lacs manday annually-labour drawn mostly from rural areas. The activities of the organisation have recently extended outside the State when a timber Sales Depot at Panjabi Bagh Rohtak Road Delhi Started functioning.

The organisation has been growing steadily but surely as is evident from the following statistical information.

Year	Revenue in Lac Rupees	Expenditure in Lac Rs.
1975-76	469.24	280.94
1976-77	660.83	366.00
1977-78	787.50	368.30
1978-79	889.57	410.76
1979-80	1819.74	418.72
1980-81	1240.81	523.87

Whenever you are in the need of timber of good quality. Please insist on quality marks :—

DLP, GLU, JKSFC and FORCORP :

For further information and trade enquiries please contact :—

	Telephone Numbers		
	Srinagar	Jammu	Delhi
N.A. Masoodi,	72838	5391	372093
Managing Director	72833		
P.N. Pandita,	72830	5391	611210
General Manager,	76229		
(Sales & Marketing)			
Y.S. Narsinghia	——	5391	386261
D.M. Sales,		43327	
Jammu/Delhi,			
D.M. Sales,	——	——	——
North Divn. Srinagar.			
Divisional Manager			
Sales South Pampore	——	——	——

GRAMS :- LUMBERING

Issued by

N.A. Masoodi, I.F.S.
Managing Director,
(J & K), State Forest Corporation,
Srinagar.

Tamil Nadu Forest Plantation Corporation, Ltd.

(A Government of Tamil Nadu Undertaking)

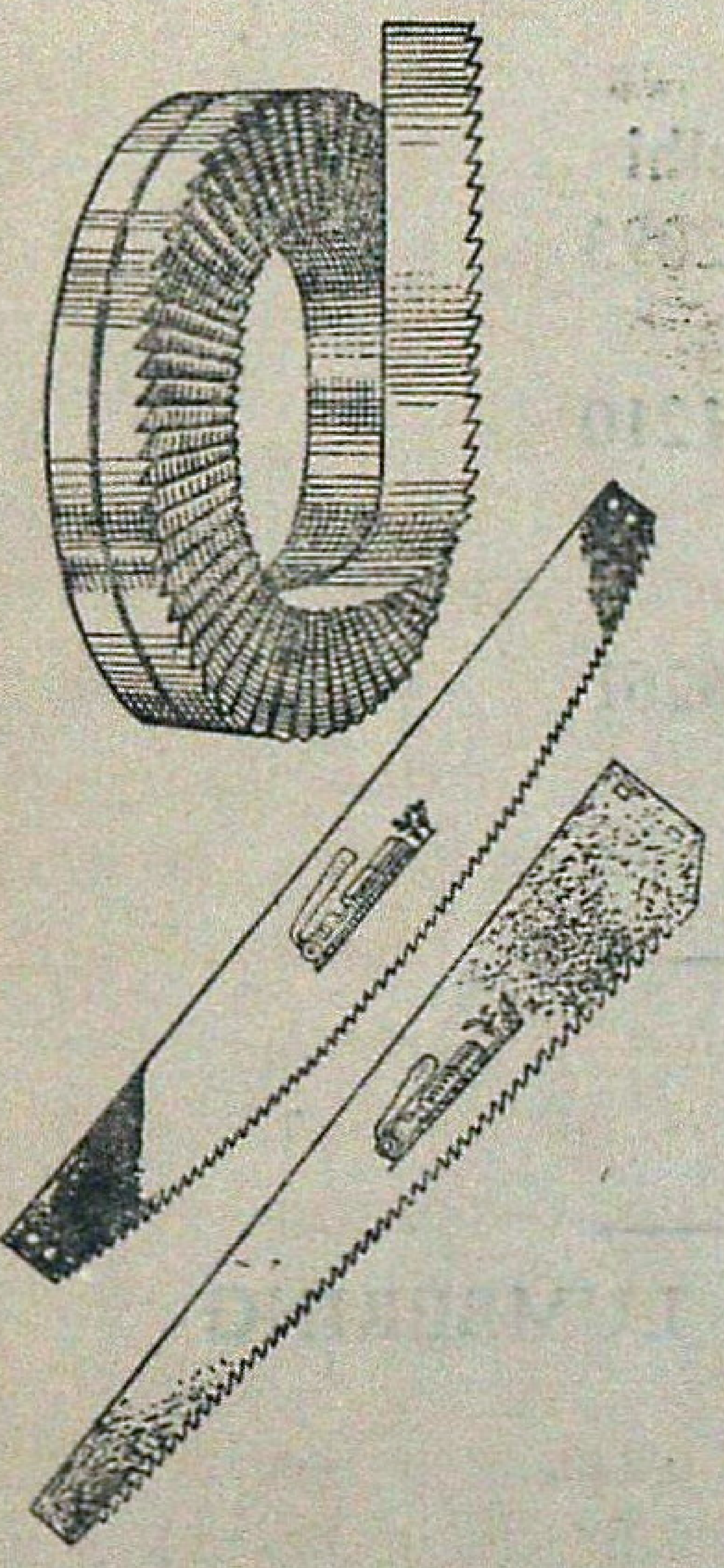
Regd. Office :
A—8, 11 Cross, Thillainagar,
Tiruchirapalli–620018
Phone 5147

we supply annually over 40,000 tonnes pulpwood to the wood based industries from our *Eucalyptus hybrid* plantations. Over 1000 tonnes of raw Cashewnuts are also harvested from our Cashew Plantations annually and sold in auction.

Please contact our Regional Managers, at Tiruchirapalli, Pudukottai, Cuddalore (South Arcot District) and Karaikudi (Ramanathapuram District) or the Registered Office.

The Manager,
Tamil Nadu Forest Plantation Corporation Ltd.,
No. 4, Promenade Road, III, Floor (Rear Portion),
Cantonment, Tiruchirapalli—620001 (Tamil Nadu)

8/81—7/82



JAISAW®
Trade Mark

For all types of
Wood Cutting Saws :-
Band Saw Blade,
Cross Cut Saws,
Pit Saws, Web Saws,
Circular Saws.
Hand Saws,

RIKHABCHAND JAINY & SONS
28/1. DWARKADHISH ROAD (OPP. KAMLA TOWER)
KANPUR-208001 · PHONE : 53324

WITH BEST COMPLIMENTS FROM :

Telex : 0846 232 VMLS IN
Grams : VENMILLS
Ph. : Fac. 21[illegible]05, 23100
Res. 21156

VENEER MILLS

4061/1, Jalpuri Extension
P.O. Box 31
MYSORE : 570007

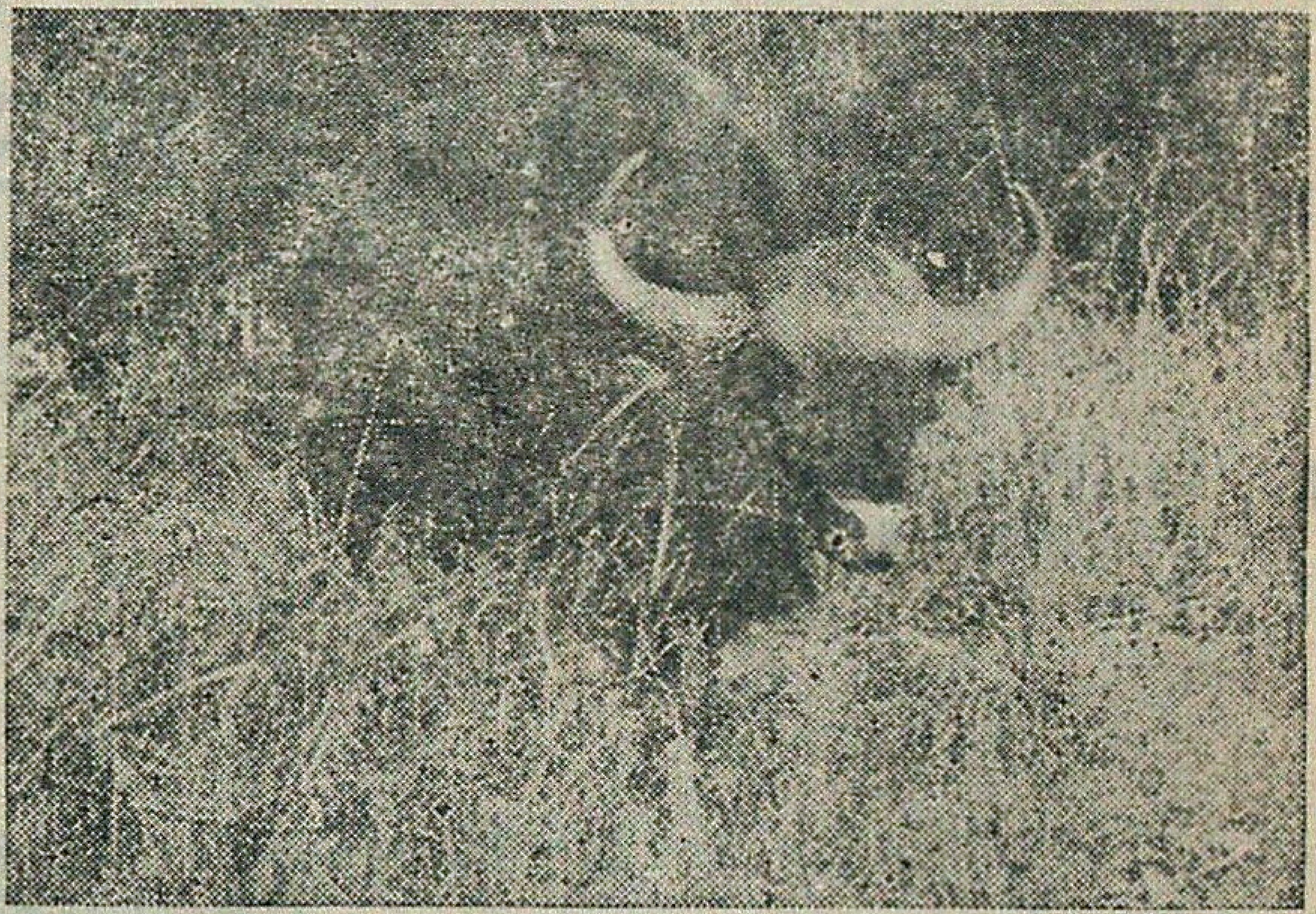
Manufacturers and Exporters of fine quality Commercial Plywood, Batten Boards & Allied Products

Stockists for Maharashtra :
Phone : 095571
M/s Saleh & Brothers
Adie Mansion, 1st Floor,
324, Maulana Shaukatbali Road, Next to Super Cinema, Bombay : 400 007

Sales Office for Tamilnadu
Phone : 25800
M/s Veneer Mills
(MYSORE) 2nd Floor
No. 1, Phillips Street
Madras : 600 001.

VISIT : **Palamau National Park**

- Famous for the abundance and variety of wild life—Tiger, Panther, Elephant, Gaur, Samber, Spotted deer, Barking deer and numerous species of beautiful birds,
- Picturesqui Scenery.
- A place of historical importance—the old and the new Palamau Fort of Chero Kings.
- Ideal holiday resort.
- Well furnished tourist Lodges and Forest Rest Houses with catering arrangement.
- Beautiful Watch Towers, tree-top and Hide-outs-all connected by roads.
- Remains open throughout the year.
- Snaps and movie permitted free of charge.
- Approachable by road and rail—26 kms from Daltonganj and 12 kms from Chhipadohar Rly. Station. Well connected by roads with comfortable Bus service.
  Nearest Airport—Ranchi—175 kms.

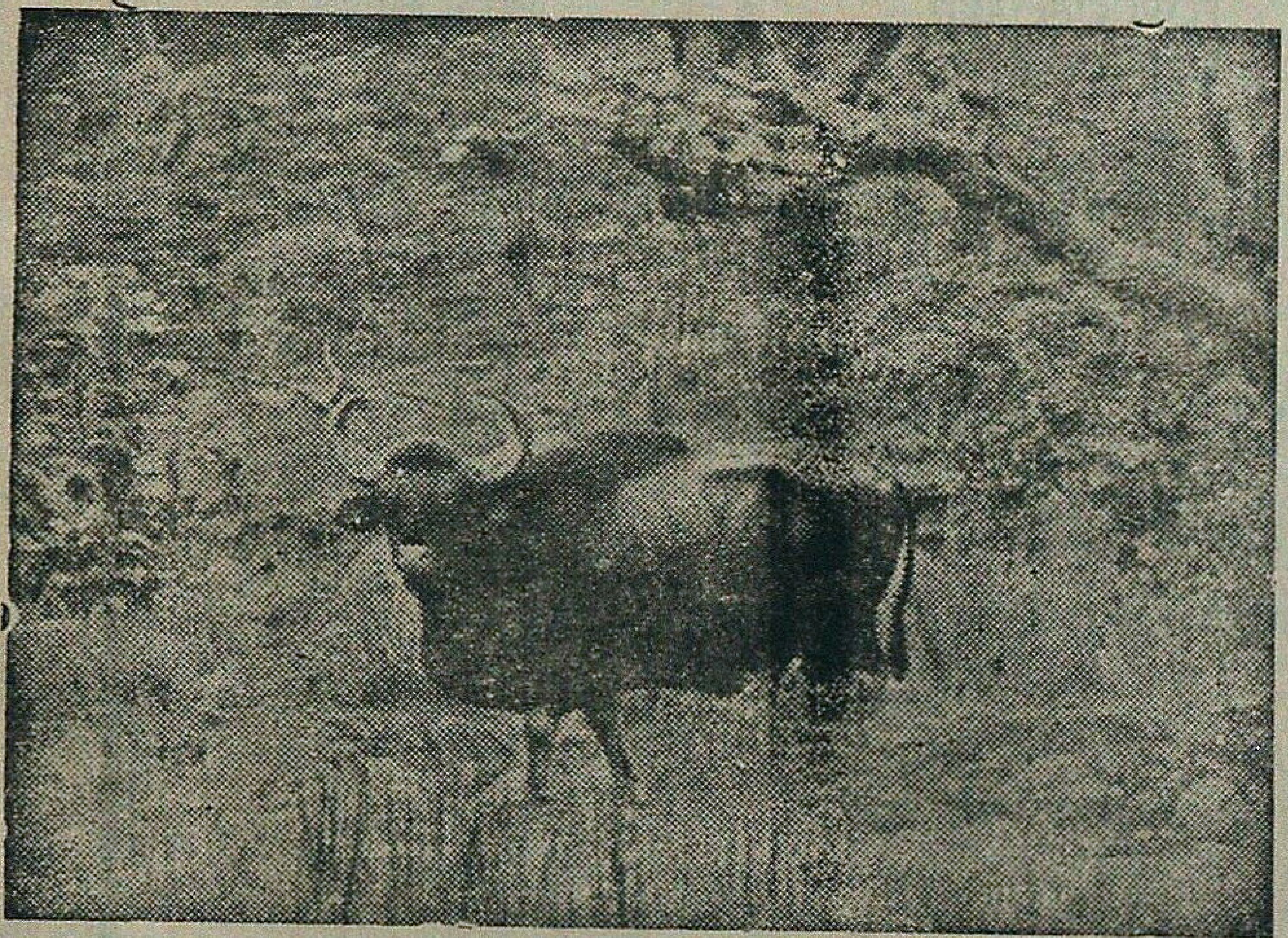


For further particulars write to :

THE FIELD DIRECTOR, PROJECT TIGER,
Palamau Tiger Reserve,
P.O. Daltonganj, Bihar (India)

3/82—2/83

BANDIPUR GAME SANCTUARY—KARNATAKA STATE



SEE THE WILD ANIMALS IN THEIR FREE STATE AND ENJOY THE THRILL.

The Bandipur Game Sanctuary the *Sanctun Sanctorum* within the Venugopal Wild Life Park in Karnataka State is an ideal holiday resort to see and enjoy the movements of Deer, Bison, Panther Tiger, Elephants, Bears, etc., at close range in their natural habitat amidst rolling panorama of hills, valleys, brooks and ponds.

- Elephant rides are arranged and snaps and movies are permitted to be taken on payment.
- The Sanctuary is only 50 miles from Mysore on the Mysore Ootacamund Trunk Road.
- Comfortable passenger buses ply from Mysore.
- May-September is the ideal period for observing game.
- Accommodation in Forest Lodge and Dak Bungalow can be booked in advance.

Contact : DISTRICT FOREST OFFICER, MYSORE

WHATEVER YOUR NEED

There is a Species of

ANDAMANS TIMBERS

TO SUIT YOUR REQUIREMENTS

CONTACT :

1. **The Chief Conservator of Forests,**
Andamans & Nicobar Islands,
Port Blair.

2. **The Deputy Conservator of Forests**
(Depot Division)
Andamans Govt. Timber Depot,
3-A, 2nd Floor Auckland Place,
Calcutta—17.

3. **The Assistant Conservator of Forests,**
(Depot Division)
Andamans Govt. Timber Depot.
Marshalling Yard, Port Trust, MADRAS.

3/82 –2/83

AVPL

OUR BRAND :	OUR PRODUCT :
FORCOPLY FORCODECOR FORCOBOARD FORCODOOR	PLYWOOD BLOCKBOARD FLUSHDOOR

PHONE : OFFICE—26-5226 27-0061 FACTORY—611-331 GRAM : VANUDYOG

ALOK UDYOG VANASPATI & PLYWOOD LTD.

6-A, RAJA SUBODH MULLICK SQ., CAL-13
7th Floor

AUTHORISED CONTROLLER

WEST BENGAL FOREST DEVELOPMENT CORPN. LTD.

(GOVT. OF WEST BENGAL UNDERTAKING)

RULES OF CONTRIBUTIONS

1. Contribution should be sent to the Honorary Editor, *Indian Forester*, Forest Research Institute, P.O. New Forest, Dehra Dun, or to any Member of the Board of Management or Central Editorial Board and should be written legibly in ink *preferably* typed.

2. The Central Editorial Board does not hold itself responsible for the opinions expressed by the authors.

3. The Central Editorial Board reserves the right of accepting or rejecting any contribution and of making suitable alterations and amendments, without assigning any reason.

4. Contributors are invited to sign their contributions in preference to affixing to them a *nom de plume*, since professional opinion naturally carry more weight when their author is known. All communications must be authenticated by the name and address of the writer being communicated to the Honorary Editor, whether intended for publication or not.

5. Contributors will be supplied with 30 extra copies of their contributors, together with any illustrations accompanying them, free of charge. Additional copies will be charged for at the rate of twenty paise per page per reprint. *Contributors desiring extra copies should state the number of reprints required when sending articles, otherwise they will not be available.*

6. No payments will be made to members of Govt. organisation for their contributions to the *Journal* but it will be open to the Honorary Editor, to make payments for articles accepted from the outside public.

INSTRUCTIONS TO CONTRIBUTORS

Title—This should be brief, carefully chosen, and indicative of the contents of the article. It should be inserted on the top of the first page in block capitals.

Authors—The name of the author and his status should appear immediately under the title, but need not be entirely in capitals.

Introduction—An introduction presenting the general object of the work, and the scope and importance of the problem is, desirable.

Presentation—The matter should be neatly written, or typed double or treble spacing, on one side only of fullscape size paper with a left hand margin of 4 cm and margins of 2.5 cm at the top and bottom of each page except the opening page where the top margin should be 4 cm. The sending of the contributions in duplicate is recommended.

Summary—A condensed account of the important contents of the article should be at the end of article. The summary should be self-explanatory, complete and clear in itself, avoiding, as far as possible, technicalities.

Illustrations—The number of illustrations should be kept at a minimum as their reproduction is costly. Photographs and drawings should, if possible, be made to the correct proportion of the printed page of the magazine (20 cm by 15 cm). Nothing should be written in pencil or ink, or type-written on the back of illustrations as they cause trouble in reproduction. Photographs and illustrations should not be pinned or swen with thread as such pine holes reproduce in photography. The former should be in black and white, with pronounced contrasts and glossy finish; the later should be neatly drawn in Indian ink on white thick paper or drawing paper. Graph paper should preferably have black co-ordinate line son white background. Captions should be typed or written on separate strips of paper and attached with colourless adhesives to the back of the prints. The approximate place where the illustrations are to be inserted should be indicate in the text, and the illustrations should be serialy numbered. In mailing illustrations should be placed between cardboards held together by thin thread or rubber bands.

Copyrighted pictures or photographs from commercial photographers should not be sent.

Punctuations—Authors should pay special attention to punctuation as this greatly aids the reader in understanding the author clearly; if this is left to the editor, a wrong punctuation made by him may alter the author's intended meaning of a sentence.

Citations—The Bibliography should be given at the end of the article on separate sheet of paper and should be typewritten double-spaced throughout. Reference to a citation in the text should be made by means of the author's name followed by a reference number in parentheses. In the bibliography the citation should be preceded by the reference number. The citation will consist of the serial number, the author's name and initials (in large and small capitals), the year of publication, the title of the article, the title of the book, paper or periodical, volume number and date of issue and the page numbers, thus:

Hamilton, A.P.F.,: 1947. Farm Forestry in India. *Indian For.*, 74 (3), 84–88

Corrections—Authors are requested to see that their typescripts incorporate all corrections they desire to be carried out as no revisions are permitted by the press in the proof stage and any resetting involves heavy cost.

Capitals—Normally, typewritten or handwritten matter should show where capitals are to be used. If a whole wordor line has to be printed entirely in capitals the original should also be so written. To indicate italics a single straight line should be drown under the matter concerned in the original text.
For detailed instructions see the editorial in the *Indian Forester* of May, 1950.

70
10
820
54

THE INDIAN FORESTER

Library

VOLUME 108 JULY, 1982 NUMBER 7

BHARELI RIVER ENTERING PLAINS AT TIPPI, WEST KAMENG DISTRICT, ARUNACHAL PRADESH. Photo—Pratap Singh ... Front Cover

CONTENTS

ARTICLES

INTERRELATIONSHIP OF WOOD YIELD COMPONENTS IN *EUCALYPTUS TERETICORNIS*. M. Rathinam, C. Surendran and S Kondas ... 465

A COMPARATIVE STUDY OF SALINE-SODIC, SODIC AND NORMAL SOILS IN RELATION TO FOREST GROWTH OF SOUTH KHERI FOREST DIVISION, (U.P.). K. Singh, S.K. Sharma, R.M. Singhal, J.S. Samra and S.D. Sharma ... 471

LABORATORY EVALUATION OF SOME INSECTICIDES AGAINST THIRD INSTAR LARVAE OF *SELEPA CELTIS* MOORE (NOCTUIDAE : LEPIDOPTERA). B.K. Gupta, Vijay Veer and P.K. Sen-sarma ... 481

HOT SETTING ANIMAL GLUE COMPOSITION FOR TEA-CHEST PLY-WOOD. R.C. Gupta, M.S. Rajawat and J.K. Bagga 487

CROWN DEVELOPMENT OF *CEDRUS DEODARA*. S.P. Singh ... 490

SCHEFFLERA HOI (DUNN) VIGUIER (ARALIACEAE)—A TREE NEW TO INDIA. H.B. Naithani and S.S.R. Bennet 495

GRAFTING AND BUDDING IN YEMANE, *GMELINA ARBOREA* ROXB. R.S. Arya and M.S. Haque 497

BUCHANANIA LANZAN, SPRENG.—STUDIES ON METHODS OF PROPAGATION AND ESTIMATION OF FRUIT YIELD. Y.C. Rai ... 501

UTILISATION OF WOOD, CANE AND BAMBOO FOR HANDICRAFTS J.C. Jain and M.C. Tewari 512

INDIGOFERA TORULOSA W. KHAN—A NEW SPECIES FROM THE DECCAN PLATEAU. M.A. Wadood Khan 516

INFLUENCE OF GRAZING ON THE ROOT DEVELOPMENT OF HERBAGE SPECIES IN A TROPICAL GRASSLAND AT KANPUR, INDIA. L.C. Mishra 519

A STUDY ON THE STRENGTH OF 5 MM DIA COMMON WIRE NAILS UNDER VARIED CONDITIONS OF MEMBERS THICKNESSES (DOUBLE SHEAR AND QUADRUPLE SHEAR) IN STRUCTURAL JOINTS OF *PTEROCARPUS DALBERGIOIDES*. K.S. Pruthi and A.N. Bajaj 522

LETTER TO THE EDITOR 535

GAZETTE NOTIFICATIONS 538

OBITUARIES ... . Art Paper

CENTRAL EDITORIAL BOARD

K.M. TIWARI, I.F.S. *(President)*, O.N. KAUL, I.F.S. *(Hony. Editor)*,
C.S. Kirpekar, I.F.S., M.M. PANT, I.F.S

Edited by O.N. Kaul, I.F.S. Honorary Editor, Indian Forester (Director, Forestry Research, Forest Research Institute & Colleges, Dehra Dun), Published & Printed by N.K. Mathur, I.F.S., Business Manager, Indian Forester (Officer-in-Charge, Central Documentation & Library Branch, Forest Research Institute & Colleges, Dehra Dun) and Printed at Print World, Dehra Dun.

Registered No. **D.N. 36**